Appendix B: SURFACE STIPULATIONS APPLICABLE TO ALL SURFACE DISTURBING ACTIVITIES

With the exception of Lease Notice 1, which is already in the White River ROD/RMP, the following Surface Stipulations would be added to Appendix A of the White River ROD/RMP, dependent upon which alternative is selected:

Table B-2: Controlled Surface Use Stipulations

Stip Code	Protected Resource	Affected Acreage	Stipulation Description
CSU-9	Key Wild Horse Habitat	11,501	**Key Wild Horse Habitat**: Only short-term development activity, such as pipeline and powerline installation, which does not require continuous maintenance, will be allowed. Road density would be limited to 1.5 miles of road per square mile. The goal is to maintain habitat needs of forage, water and cover within key wild horse habitat. **EXCEPTION**: An exception may be granted by the Field Manager if an environmental assessment indicates that the proposed action would not impair the utility of the area by wild horses. **MODIFICATION**: None. **WAIVER**: None.
CSU-10	Preferred Wild Horse Habitat	Alt's C&F 24,511 Alt's E&G 63,021	**Preferred Wild Horse Habitat.** Density of development activity will be limited. Well pads will be limited to four sites per section (four sites per square mile) with an allowance for multiple wells per pad. No increase in effective road densities (i.e. no new road construction until equivalent acreage of existing unused roads has been successfully reclaimed). Road density would be limited to 3 miles of road per square mile. The goal is to maintain habitat quality and wild horse utility by limiting development density and human activities. **EXCEPTION**: An exception may be granted by the Field Manager if an environmental assessment indicates that the proposed action would not impair the utility of the preferred habitat by wild horses. **MODIFICATION**: None. **WAIVER**: None.

Stip Code	Protected Resource	Affected Acreage	Stipulation Description
CSU-11	Wild Horse Migration Corridor	Alt E Only 8,937	**Wild Horse Migration Corridor**: Density of development activity will be limited. Well pads will be limited to two sites per section (two sites per square mile) with an allowance for multiple wells per pad. Road density will be limited to 3 miles of road per square mile. Loop roads will not be allowed. Well access roads will be gated to deter unnecessary motorized use. The goal is to develop and maintain a functional wild horse migration corridor through which wild horses would be able to move between the current occupied horse range and the usable ranges to the north. **EXCEPTION**: An exception may be granted by the Field Manager if an environmental assessment indicates that the proposed action would not impair the utility of the corridor by wild horses. **MODIFICATION**: None. **WAIVER**: None.

Table B-3: Timing Limitation Stipulations

Stip Code	Protected Resource	Affected Acreage	Stipulation Description
TL-12	Wild Horse Summer Range	24,319	**Wild Horse Summer Range**: Activities which displace horses from important summer ranges may only occur between September 1 and May 30. The goal is to maintain usability of key horse habitat by preventing activities which would act to displace the horses during the season of use. **EXCEPTION**: An exception may be granted by the Field Manager if an environmental assessment indicates that the proposed action would not impair the utility of the area by wild horses. **MODIFICATION**: None. **WAIVER**: None.

Stip Code	Protected Resource	Affected Acreage	Stipulation Description
TL-13	Wild Horse Winter Range	15,488	**Wild Horse Winter Range**: Activities which displace horses from important winter ranges may only occur between May1 and November 15. The goal is to maintain usability of key horse habitat by preventing activities which would act to displace the horses during the season of use. **EXCEPTION**: An exception may be granted by the Field Manager if an environmental assessment indicates that the proposed action would not impair the utility of the area by wild horses. **MODIFICATION**: None. **WAIVER**: None.

Table B-4: Lease Notices

Stip Code	Protected Resource	Affected Acreage	Stipulation Description
LN-1	Wild Horse Habitat Note: This Lease Notice is already in the ROD/RMP	Piceance East Douglas Horse Management Area AND West Douglas Herd Area 123,387	**Wild Horse Habitat.** This lease parcel encompasses a portion of a wild horse herd management area. In order to protect wild horses within this area, intensive development activities may be delayed for a specified 60 day period within the spring foaling period between March 1 and June 15. The lessee may be required to perform special conservation measures within this area including: 1) Habitat improvement projects in adjacent areas if development displaces wild horses from critical habitat; 2) Disturbed watering areas would be replaced with an equal source of water, having equal utility; 3) Activity/improvements would provide for unrestricted movement of wild horses between summer and winter ranges.

Appendix C: STANDARD OPERATING PROCEDURES

Methods for Humane Capture Wild Horses - Helicopter Removals with or without a Contract

The helicopter drive-trapping and helicopter herding/roping methods employed for capture operations requires that horses be herded to a trap of portable panels and/or be herded towards ropers who, after roping the animal, bring it to the trap.

Gathering would be conducted using agency personnel or contractors experienced in the humane capture and handling of wild horses. The same rules apply whether a contractor or BLM personnel are used. The following stipulations and procedures will be followed during the contract period, or throughout the duration of the BLM project to ensure the welfare, safety and humane treatment of the wild horses in accordance with the provisions of 43 CFR 4700 and, if the gather is contracted, the contractor's Gather Capture contract.

1. Traditional Capture Methods

a. Helicopter Drive Trapping

This capture method involves driving horses into a pre-constructed trap using a helicopter. The trap is constructed of portable steel panels consisting of round pipe. Wings are constructed off the ends of the panel trap to aid in funneling horses into the trap. The wings are constructed of natural jute, (or similar netting which will not injure a horse), which is hung on either trees or long steel posts. This sort of wing forms a very effective visual barrier to the horses that they typically will not run through. When the trap is ready for use, a helicopter will start moving one band of horses at a time toward the trap and into the wings.

In heavily wooded areas, it may be necessary to use wranglers in support of the helicopter to move the horses. The helicopter will act more as a spotter for the ground crew in this situation.

The contractor/BLM shall attempt to keep bands intact except where animal health and safety become considerations which would prevent such procedures. The contractor/BLM shall ensure that foals shall not be left behind.

At least one saddle-horse should be immediately available at the trap site to perform roping if necessary. Roping shall be done as determined by the Contracting Officer Representative (COR) or Project Inspector (PI). Under no circumstances shall animals be tied down for more than one hour.

Domestic saddle horses may also be used to assist the helicopter pilot (on the ground) during the gather operation, by having the domestic horse act as a pilot (or "Judas") horse on the ground, leading the wild horses into the trap site. Individual ground hazers and individuals on horseback may also be used to assist in the gather.

b. Helicopter Assisted Roping

Capture attempts may be accomplished by utilizing a helicopter to drive animals to ropers. The animals are roped by the neck and led into the trap with the help of persons riding behind the roped horse to 'haze' the horse in the right direction. Sometimes the roped horse is thrown to the ground and hobbled. The hobbled horse is then dragged into a stock trailer, freed of ropes, and transported to the corrals. Under no circumstances are horses left tied down for more than one hour.

Roping shall be performed in such a manner that mares and their foals will remain together. Foals shall not be left behind.

2. ALTERNATIVE CAPTURE METHODS

a. Helicopter Drive-Trapping/ Hazing

This technique is similar to helicopter assisted roping except the horses are herded into secluded traps without road access. After capture in an isolated trap the horses are roped and individually pulled and hazed by riders on horseback towards a trailer or into a pen with road access. The distance the horses are hazed varies and can vary from several hundred feet to a further distance. Riders hazing the horses use existing animal trails when possible but the horses are hazed cross-country when trails do not exist. A rope around the neck keeps the horses from running and riders behind and beside the horse keep it moving toward the corral or trailer. Risk of injury increases with the distance a horse must be hazed and the topography the horse travels. Steep, rocky terrain or areas of heavy tree cover can be dangerous to the horse being hazed, the riders and the saddle horses. Ropes can get wrapped around trees and bushes, animals can slip or fall.

If a horse is hazed into a corral a rider corners the horse and flips the rope off the horses' neck. The horse is pushed into a stock trailer and transported to the holding corrals.
Horses that cannot be hazed to a corral are hazed to a trailer. Once at the trailer a rider ropes the horse's legs and throws the horse on its side onto the ground. The horse is cross hobbled. A rope is run through the hobbles or around the horse's neck and the animal is dragged by the legs or the neck on its side into a trailer. Often a piece of plywood is placed under the horse to reduce injury to the animal when it is dragged. Once in the trailer the horses' legs are untied and the leg or neck rope is removed.

b. Net Gunning

Net gunning individually captures animals by aerially dropping hydraulically discharged, weighted nets over an animal. This method has been used by the Native Americans in the management of wild horses on tribal lands, by the BLM in the capture of wild burros, and by other agencies in the capture and relocation of large game and predator wildlife species. When using nets, drug and electrical immobilization are rarely required

Net gun capture is a valuable tool when specific animals are targeted for restraint, relocation or removal. The technique is not applicable when a number of animals require capture.

Individual animals are located, herded by the pilot as slowly as possible into an open area and then are netted from the helicopter using weighted, soft mesh net. Net-gunning requires swaths of open country with gentle, rolling terrain free of rocks, draws and cliffs. Meadows must be large enough to allow the pilot time to position himself around the horse, drop a net over the horse while it is running, and time for the horse to slow from a run and fall while still in the meadow. Having the horse meet steep country or tress during any of these 3 phases of capture will result in injury and mortality.

The net will fall over different horses in different positions depending on the position the net lands and the speed the horse is moving when the net lands. As a horse becomes tangled in the net it becomes disoriented and falls onto the ground. The fall can occur after they have slowed to a trot or walk, or the fall can occur immediately after being netted when the horse is running. The incident of injury increases when horses fall at a gallop when the net quickly tangles around their legs

Immediately after netting an animal the crew approaches the fallen animal. The horse is restrained by crew members placing weight on the horse's head and shoulder. The horse is cross-hobbled and blindfolded. A muzzle is used when the horse tries to bite in self-defense. Once hobbled and blindfolded, the net is rolled away from the horse and the hobbled, blindfolded animal is rolled into a canvas bag. The bag is laced closed with a nylon rope. The helicopter flies low over the horse and a crew member reaches up and hooks one end of the rope to the belly of the helicopter. The horse is lifted into the air in the canvas bag and transported to the temporary corrals. Transport time to corrals is usually under 15 minutes per animal.

Once at the destination, the animal is lowered into the corral. The ground crew unhooks the transport rope and removes the bag from around the animal. The blindfold and hobbles are removed.

c. Tranquilizer-Darting

BLM has used tranquilizer-dart gunning to capture horses. Tranquilizer-darting has been effective during the capture of large mammals when administered by skilled individuals. The risk of tranquilizer-darting for wild horses is less associated with the skill of the individuals and more related to the unpredictable effect of tranquilizer drugs on wild equines. Equine resistance and tolerance to tranquilizers varies and is unpredictable from one horse to another. Concurrence between wild horse specialists who have used tranquilizer-darting to capture wild horses and burros, and members of the veterinarian community knowledgeable of the interaction of tranquilizer drugs and equines led to the decision not to employ this technique without further research and discussion. Use of this method of capture would be analyzed in an environmental assessment separate from this appendix.

3. Stipulations for Portable Corral Traps/Exclosures

Capture traps would be constructed in a fashion to minimize the potential for injury to wild horses or burros and BLM personnel. Gates would be wired open at all unmanned trap sites, and would be left closed only when needed to hold horses inside. Trapped horses would not be held inside the traps for a period exceeding 10 hours, unless provided with feed (weed free hay) and water.

The Colorado Division of Wildlife Resources would be notified as soon as possible if any wildlife became injured during capture operations. Wildlife caught inside traps would be released immediately.

The state brand inspector would be notifed as soon as possible if domestic livestock or horses are captured during the operation. These animals would be held at the temporary corrals if advised by the brand inspector until arrangement can be made for transport of the animals.

4. Contract Helicopter, Pilot and Communications

The contractor must operate in compliance with Federal Aviation Regulations, Part 91. Pilots provided by the contractor shall comply with the Contractor's Federal Aviation Certificates, applicable regulations of the State in which the gather is located.

When refueling, the helicopter shall remain a distance of at least 1,000 feet or more from animals, vehicles (other than fuel truck), and personnel not involved in refueling.

The COR/PI shall have the means to communicate with the contractor's pilot at all times. If communications cannot be established, the Government will take steps as necessary to protect the welfare of the animals. The frequency(ies) used for this contract will be assigned by the COR/PI when the radio is used. The contractor shall obtain the necessary FCC licenses for the radio system.

The proper operation, service and maintenance of all contractor furnished helicopters is the responsibility of the contractor. The BLM reserves the right to remove from service pilots and helicopters which, in the opinion of the Contracting Officer or COR/PI, violate contract and FAA rules, are unsafe or otherwise unsatisfactory. In this event, the contractor will be notified in writing to furnish replacement pilots or helicopters within 48 hours of notification. All such replacements must be approved in advance of operation by the Contracting Officer or his/her representative.

All incidents/accidents occurring during the performance of any delivery order shall be immediately reported to the COR.

5. Animal Handling and Care

Prior to any gathering operations, the COR/PI will provide for a pre-capture evaluation of existing conditions in the gather areas. The evaluation will include animal condition, prevailing temperatures, drought conditions, soil conditions, road conditions, and a topographic map with location of fences, other physical barriers, and acceptable trap locations in relation to animal distribution. The evaluation will determine whether the proposed activities will necessitate the presence of a veterinarian during operations. If it is determined that capture efforts necessitate the services of a veterinarian, one would be obtained before capture would proceed.

The contractor will be appraised of the all conditions and will be given instructions regarding the capture and handling of animals to ensure their health and welfare is protected.

The Authorized Officer and pilot may take a familiarization flight identifying all natural hazards (rims, canyons, winds) and man-made hazards in the area so that helicopter flight crew, ground personnel, and wild horse safety will be maximized. Aerial hazards will be recorded on the project map.

No fence modifications will be made without authorization from the Authorized Officer. The contractor/BLM shall be responsible for restoration of any fence modification which has been made.

If the route the contractor/BLM proposes to herd animals passes through a fence, opening should be large enough to allow free and safe passage. Fence material shall be rolled up and fence posts will be removed or sufficiently marked to ensure safety of the animals. The standing fence on each side of the gap will be well flagged or covered with jute or like material.

Wings shall not be constructed out of materials injurious to animals and must be approved by the Authorized Officer.

It is the responsibility of the contractor/BLM to provide security to prevent loss, injury or death of captured animals until delivery to final destination.

Animals shall not be allowed to remain standing in trucks while not in transport for a combined period of greater than three (3) hours. Animals that are to be released back into the capture area may need to be transported back to the original trap site. This determination will be at the discretion of the COR.

Branded or privately owned animals captured during gather operations will be handled in accordance with state estray laws and existing BLM policy.

Capture methods will be identified prior to issuance of delivery orders. Regardless of which methods are selected, all capture activities shall incorporate the following:

a. Trap Site Selection

The Authorized Officer will make a careful determination of a boundary line to serve as an outer limit within which horses will be herded to a selected trap site. The Authorized Officer will insure that the pilot is fully aware of all natural and man made barriers which might restrict free movement of horses. Topography, distance, and current condition of the horses are factors that will be considered to set limits to minimize stress on horses (or burros).

Gather operations will be monitored and restricted (if necessary) to assure the body condition of the horses are compatible with the distances and the terrain over which they must travel. Pregnant mares, mares with small colts, and other horses would be allowed to drop out of bands which are being gathered if required to protect the safety and health of the animals.

All trap and holding facility locations must be approved by the Authorized Officer prior to construction. The situation may require moving of the trap. All traps and holding facilities not located on public land must have prior written approval of the landowner.

Trap sites will be located to cause as little injury and stress to the animals, and as little damage to the natural resources of the area, as possible. Sites will be located on or near existing roads. Additional trap sites may be required, as determined by the Authorized Officer, to relieve stress to the animals caused by specific conditions at the time of the gather (i.e. dust, rocky terrain, temperatures, etc.).

b. Trap/Facility Requirements

All traps, wings, and holding facilities shall be constructed, maintained and operated to handle the animals in a safe and humane manner and be in accordance with the following:

- Traps and holding facilities shall be constructed of portable panels, the top of which shall not be less than 72 inches high, and the bottom rail of which shall not be more than 12 inches from ground level. All traps and holding facilities shall be oval or round in design.

- All loading chute sides shall be fully covered with plywood (without holes) or like material. The loading chute shall also be a minimum of 6 feet high.

- All runways shall be of sufficient length and height to ensure animal and wrangler safety. and may be covered with plywood, burlap, plastic snow fence or like material a minimum of 1 foot to 5 feet above ground level for burros and 1 foot to 6 feet for horses.

- If a government furnished portable chute is used to restrain, age, or to provide additional care for animals, it shall be placed in the runway in a manner as instructed by or in concurrence with the Authorized Officer.

- All crowding pens including the gates leading to the runways may, if necessary to prevent injuries from escape attempts, be covered with a material which prevents the animals from seeing out (plywood, burlap, snow fence etc.) and should be covered a minimum of 1 foot to 5 feet above ground level for burros and 2 feet to 6 feet for horses.

- When holding facilities are used, and alternate pens are necessary to separate mares or jennies with small foals, animals which will be released, sick and injured animals, and estrays from the other animals or to facilitate sorting as to age, number, size, temperament, sex, and condition. They will be constructed to minimize injury due to fighting and trampling. In some cases, the Government will require that animals be restrained for determining an animal's age or for other purposes. In these instances, a portable restraining chute will be provided by the Government. Either segregation or temporary marking and later segregation will be at the discretion of the COR.

- If animals are held in the traps and/or holding facilities, a continuous supply of fresh clean water at a minimum rate of 10 gallons per animal per day will be supplied. Animals held for 10 hours or more in the traps or holding facilities shall be provided good quality hay at the rate of not less than two pounds of hay per 100 pounds of estimated body weight per day.

- Separate water troughs shall be provided at each pen where animals are being held. Water troughs shall be constructed of such material (e.g. rubber, rubber over metal) so as to avoid injury to animals.

- When dust conditions occur within or adjacent to the trap or holding facility, the contractor/BLM shall be required to wet down the ground with water.

6. Treatment of Injured or Sick; Disposition of Terminal Animals

The contractor/BLM shall restrain sick or injured animals if treatment is necessary. A veterinarian may be called to make a diagnosis and final determination. Destruction shall be done by the most humane method available. Authority for humane destruction of wild horses (or burros) is provided by the Wild Free-Roaming Horse and Burro Act of 1971, Section 3(b)(2)(A), 43 CFR 4730.1, BLM Manual 4730 - Destruction of Wild Horses and Burros and Disposal of Remains, and is in accordance with BLM policy as expressed in Instructional Memorandum No. 98-141.

Any captured horses that are found to have the following conditions may be humanely destroyed:

- The animal shows a hopeless prognosis for life.
- Suffers from a chronic disease.
- Requires continuous care for acute pain and suffering.
- Not capable of maintaining a body condition rating of one or two.
- The animal is a danger to itself or others.

The Authorized Officer will determine if injured animals must be destroyed and provide for destruction of such animals. The contractor/BLM may be required to dispose of the carcasses as directed by the Authorized Officer.

The carcasses of the animals that die or must be destroyed as a result of any infectious, contagious, or parasitic disease will be disposed of by burial to a depth of at least 3 feet.

The carcasses of the animals that must be destroyed as a result of age, injury, lameness, or noncontagious disease or illness will be disposed of by removing them from the capture site or holding corral and placing them in an inconspicuous location to minimize visual impacts. Carcasses will not be placed in drainages regardless of drainage size or downstream destination.

7. Motorized Equipment

All motorized equipment employed in the transportation of captured animals shall be in compliance with appropriate State and Federal laws and regulations applicable to the humane transportation of animals. The contractor shall provide the Authorized Officer with a current safety inspection (less than one year old) of all tractor/stock trailers used to transport animals to final destination.

Vehicles shall be in good repair, of adequate rated capacity, and operated so as to ensure that captured animals are transported without undue risk or injury.

Only stock trailers with a covered top shall be allowed for transporting animals from trap site(s) to temporary holding facilities. Only stock trailers, or single deck trucks shall be used to haul animals from temporary holding facilities to final destination(s). Sides or stock racks of transporting vehicles shall be a minimum height of 6 feet 6 inches from the vehicle floor. Single deck trucks with trailers 40 feet or longer shall have two (2) partition gates providing three (3) compartments within the trailer to separate animals. The compartments shall be of equal size plus or minus 10 percent. Trailers less than 40 feet shall have at least one partition gate providing two (2) compartments within the trailer to separate animals. The compartments shall be of equal size plus or minus 10 percent. Each partition shall be a minimum of 6 feet high and shall have at the minimum a 5 foot wide swinging gate. The use of double deck trailers is unacceptable and will not be allowed.

All vehicles used to transport animals to the final destination(s) shall be equipped with at least one (1) door at the rear end of the vehicle, which is capable of sliding either horizontally of vertically. The rear door must be capable of opening the full width of the trailer. All panels facing the inside of all trailers must be free of sharp edges or holes that could cause injury to the animals. The material facing the inside of

the trailer must be strong enough, so that the animals cannot push their hooves through the sides. Final approval of vehicles to transport animals shall be held by the Authorized Officer.

Floors of vehicles, trailers, and the loading chute shall be covered and maintained with materials sufficient to prevent the animals from slipping.

Animals to be loaded and transported in any vehicle or trailer shall be as directed by the Authorized Officer and may include limitations on numbers according to age, size, sex, temperament, and animal condition. The minimum square footage per animal is as follows:

- 11 square feet/adult horse (1.4 linear foot in an 8 foot wide trailer)
- 8 square feet/adult burro (1.0 linear foot in an 8 foot wide trailer)
- 6 square feet/horse foal (0.75 linear foot in an 8 foot trailer)
- 4 square feet/burro foal (0.50 linear foot in a 8 foot wide trailer)

The Authorized Officer shall consider the condition of the animals, weather conditions, type of vehicles, distance to be transported, or other factors when planning for the movement of captured animals. The Authorized Officer shall provide for any brand and/or inspection services required for the captured animals.

Communication lines will be established with personnel involved in off-loading the animals to receive feedback on how the animals arrive (condition/injury etc.). Should problems arise, gathering methods, shipping methods and/or separation of the animals will be changed in an attempt to alleviate the problems.

If the Authorized Officer determines that dust conditions are such that animals could be endangered during transportation, the contractor/BLM will be instructed to adjust speed and/or use alternate routes.

Periodic checks by the Authorized Officer will be made as animals are transported along dirt roads. If speed restrictions are in effect the Authorized Officer will at times follow and/or time trips to ensure compliance.

8. Special Stipulations.

Private landowners or the proper administering agency(s) would be contacted and authorization obtained prior to setting up traps on any lands which are not administered by BLM. Wherever possible, traps would be constructed in such a manner as to not block vehicular access on existing roads.

If possible, traps would be constructed so that no riparian vegetation is contained within them. Impacts to riparian vegetation and/or running water is located within a trap (and available to horses) would be mitigated by removing horses from the trap immediately upon capture. No vehicles would be operated on riparian vegetation or on saturated soils associated with riparian/wetland areas.

Gathering would be conducted when soils are dry or frozen and conditions are optimal for safety and protection of the horses and wranglers. Whenever possible, schedule gather activities to minimize impacts with big game hunting seasons.

Gathers would not be conducted 6 weeks on either side of peak foaling season, recognized as between the first of March and June 15th of any given year. The delay in gathers will reduce the chance of injury or stress to pregnant mares or mares with young foals.

The helicopter would avoid eagles and other raptors, and would not be flown repeatedly over any identified active raptor nests. No unnecessary flying would occur over big game on their winter ranges or active fawning/calving grounds during the period of use.

Standard operating procedures in the site selection and construction of traps will avoid adverse impacts from trap site selelction, construction, and operation to wildlife species, including threatened, endangered, or sensitive species.

9. Herd Health and Viability Data Collection

The following information will be collected form each animal captured: age, sex, color, overall health, pregnancy or nursing status.

In addition, blood or hair samples may be collected from individuals within the herd. Certain other activities including immunocontraceptive research radio collaring, and freeze marking may be conducted.

Population Management Plan/Selective Addition or Removal: Blood samples will be taken for the purposes of furthering genetic ancestry studies and incorporation into the Population Management Plans which will be developed for each HMA/complex. If necessary, animals will be introduced into the herd as a means to enhance and maintain genetic herd diversity. Introduced animals will be taken from areas with similar habitat and climatic characteristics.

10. Public Participation

Prior to conducting a gather a communications plan or similar document summarizing the procedures to follow when media or interested public request information or viewing opportunities during the gather should be prepared. The public must adhere to guidance from the agency representative and viewing must be prearranged.

11. Safety

Safety of BLM employees, contractors, members of the public, and the wild horses (or burros) will be given primary consideration. The following safety measures will be used by the Authorized Officer and all others involved in the operation as the basis for evaluating safety performance and for safety discussions during the daily briefings:

- A briefing between all parties involved in the gather will be conducted each morning.
- All BLM personnel, contractors and volunteers will wear protective clothing suitable for work of this nature. BLM will alert observers of the requirement to dress properly. BLM will assure that members of the public are in safe observation areas.
- The handling of hazardous, or potentially hazardous materials such as liquid nitrogen and vaccination needles will be accomplished in a safe and conscientious manner by BLM personnel or the contract veterinarian. (Refer to page 28, Hazardous Materials.)

12. Responsibility and Lines of Communication

The Contracting Officer's Representative, and Project Inspectors, from White River Field Office, have the direct responsibility to ensure the contractor's compliance with the contract stipulations.

The Assistant Field Manager for Renewable Resources and the White River Field Manager will take an active role to ensure the appropriate lines of communication are established between the field, Field Office, State Office, and Canon City offices.

Appendix D: SUMMARY OF IMMUNOCONTRACEPTIVE RESEARCH

Fertility control research (immunization of select mares) completed to date indicates the immunization formula, Porcine Zona Pellucida (PZP) is highly effective for 12 to 22 months following administration depending on the time-release options selected. The reproductive success of treated mares returns to normal the year following administration of the 12 month PZP. The 22 month PZP is not desirable in locations where mares foal in narrow timeframes (March to tJune). Mares conceiving late in the breeding season results in foals being born late in the foaling season; occurances that can equate to young foals not being able to survive inclement winter weather extremes. The PZP is delivered as an intramuscular injection by a jabstick syringe at the time of the gather operation. A single injection of the vaccine results in one year of contraception at approximately 90% efficiency.

Fertility control, combined with capture and removal, was analyzed in Alternatives E, F, and H as a means to manage herd size. Treatment of animals was limited to mares between 6 and 9 years of age that were captured during the gather project. Additional mares were not identified for capture and treatment.

Projections of the success of immunocontraception within the age and gather selection restraints identified above were calculated as follows for alternatives E and F and Alternative H:

The Jenkins Population Model Program was used to pro-rate the age structure and sex ratio of horses captured during the 2001 West Douglas gather. This structure was then pro-rated to estimate the age structure/sex ratio of a herd of 207 animals; the upper management range of alternatives E and F.

Treating only the select age group mares that are captured, and not continuing to capture additional mares for treatment resulted in nominal, or no reduction in herd increase. Results of the analysis suggested that herd reproduction would be reduced by less than 1%, using the technique and variables described above. For this reason, the use of fertility control, combined with capture and removal, was not analyzed in-depth for the various alternatives. Upon final selection of a management alternative fertility control will be re-addressed in accord with current program directives. At that time the benefits of continuing to capture and treat additional mares after AML has been reached will be analyzed.

Results of the analysis described above were supported by the Jenkins Population Model program. The Jenkins model was used to compare average herd increase with and without immunocontraception for a population of 207 horses (Alternatives E and F) and for a population of 643 horses (alternative H). 25 trials were run for each alternative; with and without fertility control. The difference in herd increase with fertility control and without fertility control remained less than 2% for each of the 25 trials run for each alternative.

Another reason fertility control was not fully analyzed was due to the lack of genetic diversity existing in the herd. Eliminating the prime breeding age mares every fourth year from the gene pool would hinder efforts to increase genetic diversity in the herd. Contraception has been hypothesized as conducive to protecting existing herd genetic diversity, but has not been identified as a means to increase or strengthen existing herd genetics. The AML ranges in alternatives C, D, E and F are not large enough to assure genetic recovery without the introduction of animals from outside the herd; much less able to bear the results of eliminating mares in specific age groups from contributing to herd genetics. Finally, depending upon which mares are selected for treatment, contraception has the potential to disrupt natural selection; a situation that could further hinder attempts for genetic recovery of the herd.

Appendix E: HERD GENETICS

Genetic Analysis of the West Douglas CO feral Horse Herd

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2-6-2002

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The following is a report of the genetic analysis of the West Douglas, CO feral horse herd.

METHODS

A total of 32 blood samples were received by the Univ. of Kentucky on October 13, 2001. Seventeen genetic marker systems were analyzed. Seven systems were red blood cell alloantigen loci (the *A, C, D, K, P, Q* and *U* horse blood groups) tested by standard serological methods of aggulutination and compliment mediated hemolysis. The other 10 systems were biochemical polymorphisms detected by electrophoretic techniques. These systems were Albumin *(ALB),* Alpha-l-beta Glycoprotein *(AJB),* Serum Cholinesterase (ES), Vitamin D Binding Protein (GC), Glucose Phosphate Isomerase *(GPI),* Alpha Hemoglobin *(FIB),* Phosphoglucomutase *(PGM),* Phosphogluconate Dehydrogenase *(PGD),* Protease Inhibitor (PI), and Transferrin *(TRF).* In addition to the above genetic systems, DNA was-extracted from the blood samples and tested for variation at 12 equine microsatellite (mSat) systems. These were *AHT4, AHT5, ASB2,* ASB17, *ASB23, HMS3, HMS6, HMS7, HTG4,* HTG10, *LEX33,* and *VHL20.* These systems were tested using an automated DNA sequencer to separate Polymerase Chain Reaction (PCR) products.

A variety of genetic variability measures were calculated from the gene marker data. The measures were observed heterozygosity (Ho) which is the actual number of loci heterozygous per individual and is based upon biochemical loci only; expected heterozygosity *(He)* which is the predicted number of heterozygous loci based upon gene frequencies and was calculated for biochemical loci and all marker systems *(Het);* effective number of alleles *(Ae)* which is a measure of marker system diversity; total number of variants *(TAW);* estimated inbreeding level *(Fis)* which is calculated as *1-Ho/He.* These same measures were calculated for the mSat data. However, the DNA data will not be reported due to limited comparative information.

Genetic markers also can provide information about ancestry in some cases. Genetic resemblance to domestic horse breeds was calculated using Rogers' genetic similarity coefficient, S. This resemblance was summarized by use of a restricted maximum likelihood (RML) procedure.

RESULTS AND DISCUSSION

Variants present and allele frequencies for the blood group and biochemical markers are given in Table 1. No variants were observed which have not been seen in horse breeds. Table 2 gives the values for the genetic variability measures of the West Douglas horse herd. Also shown in Table 2 are values for other Colorado feral horse populations plus values from a representative group of domestic horse breeds. The breeds were selected to cover the range of variability measures in domestic horse populations. Mean values for feral herds (based upon data from 54 herds) and mean values for domestic breeds (based upon 118 domestic horse populations) also are shown.

Mean genetic similarity of the West Douglas herd to domestic horse breed types are shown in Table 3. Table 4 shows the genetic similarity matrix for comparison of Colorado feral populations to each other. A dendrogram of relationship of the West Douglas herd to a standard set of domestic breeds (some breeds included in the analysis are not shown individually but are grouped into a breed class for the tree) is shown in Figure 1. This is a consensus tree from 20 individual RML runs. The numbers in the tree are the percentage of runs where the grouping to the right of the number occurred. Figure 2 shows the relationships among the Colorado feral herds.

Genetic variants: Two genetic variants that are uncommon in domestic horse breeds were observed in the West Douglas herd. These were the *PGD-D* variant and the *A-be* variants, each seen in two individuals. The *PGD-D* variant does not seem to be associated with any particular breed type while-the *A-be* variant is extremely rare.

A total of 57 variants were observed which is between the mean values of feral populations and domestic breeds. Of these, 17 occurred at a frequency of less than 0.05 and thus are at high risk of loss. This high proportion of rare alleles suggests a diverse origin of the herd.

Genetic variation: Individual variation of the West Douglas herd is extremely low (Ho 0.269). This is the lowest variation seen in any of the Colorado herds and among the lowest observed in any horse population. *He* also is low but is somewhat higher than *Ho* indicating some inbreeding.

There is a high degree of allelic diversity however, as indicated above; much of the diversity is due to variants present only at very low frequency. The overall pattern of variability suggest a large population that has been reduced in size and has experienced a loss of genetic variation due to both genetic drift and inbreeding.

Genetic similarity: Highest genetic similarity of the West Douglas herd was with the Gaited North American Breeds followed by the Iberian Breeds. Highest individual breed S was with the Mountain Pleasure Horse which is a breed that shows affinity to much of the North American riding stock. This resemblance is supported by the position of the herd in the dendrogram (Figure 1). The origin of this herd is probably North American riding stock. The Iberian similarity is probably due to the Spanish ancestry of many of the North American breeds rather than direct Spanish ancestry of the West Douglas herd.

The West Douglas herd has highest similarity to the Little Bookcliffs herd among the other Colorado populations. This was followed by the Sand Wash samplings and the 2000 sample from the Spring Creek HMA. These results are somewhat surprising as the other herds with lower S are geographically closer to the West Douglas herd. This discrepancy may be due to sample sizes and low overall genetic variation. However, examination of the individual types for each of the herds in the White River Resource Area and West Douglas does not reveal any evidence of direct relationship.

SUMMARY

The West Douglas herd has extremely low genetic variation, well below the proposed critical level for *Ho* of 0.31. Allelic diversity is relatively high but a large proportion of the observed variants are at high risk of loss. The loss of these alleles would likely lead to even lower heterozygosity. The pattern of variation suggest low effective population size and some inbreeding. Genetic similarity values and the RML cluster analysis indicate that this herd is primarily derived from North American riding horse breeds.

RECOMMENDATIONS

Maximum possible population size for this HMA should be maintained after introduction of some horses from outside the West Douglas area. Any horses from the White River Resource Area would be a good choice based upon *S* values. Three to four young mares would be an effective choice. The herd should be monitored for potential defects or reproductive problems that could arise from inbreeding.

End of Cothran Report.

Discussion:

Genetic effective population size (Ne) is defined as the number of breeding individuals (both male and female) that contribute to the next generation. (Singer and Zeigenfuss, 7-26-2000). The minimum value of Ne specific to a herd is the point at which the loss of genetic diversity becomes detrimental to the herd. Genetic studies (Singer, BRD-USGS and Cothran, University of Kentucky), within the last decade have attempted to establish the minimum number of wild horses needed to preserve the long term genetic viability of smaller herds (accepted as less than 200 horses). Research has identified a range of values, with the most recent period (1995-1997) resulting in an Ne value of '50' as the minimum number needed to encourage long-term genetic diversity. (Thornhill, 1993). This figure was derived from studying domestic horses and worked on the premise that each of the 50 animals contributed equally to the herd. The assumption that each horse will contribute equally in wild horse herds has been discarded by the scientific community and by individuals familiar with wild horse social behavior and herd structure. Agreement that an NE of "50" is low for wild horse herds arose from acceptance that wild horse social structure and behavior is unlike that of domestic horses. Wild horse herds are composed of harem and young stud bands.

Ne for harem band breeding animals will always be smaller than the census population since a percent of horses in any herd are under the minimum breeding age (generally accepted as 3 years for mares and 7 years for studs) and above the maximum breeding age (widely accepted as between 15 and 20 years for mares and studs); matings in wild equines are not random (harem band structure); and only a portion of breeding age wild equine males contribute genetically to a herd While the Ne for wild equines is still under debate, and has ranged as high as the 500/5,000 theory – (a minimum of 500 needed for short term management and a minimum of 5,000 needed for the long-term management of a self-sustaining population) herd-researchers speaking at BLM's 1999 Wild Horse and Burro Forum estimated a true population size (actual herd size) of at least 150 wild horses should result in an effective population size (Ne) for continued diversity in herds that already possess genetic variance. The underlines of the previous sentence are worth noting. We are alerted that the "150" figure assumes a herd with typical age structure and sex ratio. (Coates-Markle; 2002) Consequently, in herds where age structure and sex ratio have been manipulated, the true population size may need to exceed 150 animals. True population size will also need to be higher in herds that do not possess positive genetic variance.

1. Minimal Viable Population Formula; Dr. Gus Cothran

Cothran's minimum viable population (MVP) formula allows an estimate of the number of contributing adults in a given population; that is, the number of horses within any herd that successfully reproduce. The formula,

$$\frac{4\,(Nm)\,(Nf)}{Nm + Nf}$$

was derived to estimate the effective population size (Ne) of individual herds.

In Cothran's formula *Nm* is the number of males in a particular herd that contribute to the offspring in the herd.
Nf is the number of females in a particular herd that contribute offspring into the herd.

MVP was calculated for management alternatives C, E and F as follows:

Alternative C: a management range of 29 to 60 horses; mid-range of 42

Low	Second Year	Third Year	Fourth Year	Year Scheduled for Gather	Mid-Point
~29~	~ 35~	~ 42~	~ 50~	~ 60~	42 horses

Alternative E and F: a management range of 100 to 207 horses; mid-range of 144

Low	Second Year	Third Year	Fourth Year	Year Scheduled to Gather	Mid-Point
~100~	~ 120~	~ 144~	~173~	~ 208~	144 horses

In the calculations breeding equines were considered two ways: horses between the ages of 3 and 20 years or, more conservatively, horses between the ages of 3 and 15 years. (1999 WH&B Forum) Cothran's formula was used to estimate the Ne of managing herd sizes identified in alternatives C; E and F. The midpoint management level of each alternative was used for the calculations. The age structure and sex ratio of horses captured during the most recent (2001) West Douglas gather was prorated using Dr. Jenkins' population model to estimate the age structure and sex ratio of the herd sizes in the three alternatives. Calculations were made using both the 3 to 20 and the 3 to 15 breeding groups.

Applying Cothran's formula to the mid-points of alternative C results in an Ne factor of 17 and 19 for age classes 3 to 15 and 3 to 20, respectively. These numbers are notably below the minimum of 50 breeding individuals.

Applying Cothran's formula to the mid-level herd sizes in alternatives E and F results in a factor of 56 and 64 for the age classes 3 to 15 and 3 to 20, respectively. These figures may appear adequate to meet the controversial "50"number hypothesized as the minimum Ne until one takes into account the existing narrow genetic diversity of this herd, and atypical (young) age structure of the herd. Another consideration is that the figures "56" and "64" do not take into consideration the probability that only 1 of 3 studs likely contributes to the herd. The conclusion can be made that long term herd health will only be maintained in alternatives C; E and F with the continued introduction of horses from other herds.

2. Allelic Diversity: Inbreeding depression is the accumulation of numerous recessive alleles with minor deleterious effects that combine and result in a decrease of herd health and viability. Ridding a population of undesirable alleles is unlikely. Inbreeding depression in small, isolated populations can result in the loss of alleles that confer resistance to disease and the increase of harmful alleles to the population. (Axtell, 2002). An accepted means of increasing existing herd allelic diversity is to encourage the number of breeding age individuals that contribute to the herd. Maintaining a ratio of at least 50% studs is an effective, attainable management action that promotes the formation of numerous, small bands. Numerous, smaller bands encourage increased stud contribution to the herd and, consequently, increases the exchange of existing herd allelic material. (Population Viability Forum, 1999; Coates-Markle, 2002; WH&B Handbook 4710-1; Management Considerations)

3. Genetic Variation: The scientific community accepts that inbreeding depression can be reversed with the introduction of genes from unrelated individuals into the inbred population. Inbreeding depression can be permanently prevented by continued immigration of unrelated individuals every one or two generations (accepted for wild equines as a time span of between 5 and 15 years) into the local breeding population (Lande and Barrowclough 1987). The discussion section of the genetic analysis completed for the West Douglas herd by Dr. Gus Cothran recommends managing the maximum population size for this herd and the introduction of 3 to 4 mares each generation to increase genetic diversity. Cothran recognized that in the long term, after herd recovery, the introduction of 1 or 2 mares each generation should suffice in maintaining herd diversity working on the understanding that this herd would be genetically tested during each gather activity in the short term as a means to track changes in herd variability.

Appendix F: PASTURE VEGETATIVE ANALYSIS

In each pasture vegetation analysis there is an analysis of site similarity, trend, objectives and carrying capacity for each plant community. Each pasture summary table shows the seral rating system used by BLM to rate rangeland plant communities in comparison to the potential natural plant community for a particular rangeland site. Trend ratings are a determination of the current plant communities developmental direction from the climax community. These estimates are based upon professional judgments of the Rangeland Management Specialist trained in the use of the rating system. Badlands, Douglas-fir, dry exposure and rock outcrop are not considered as range sites and are designated as Not Applicable (NA) for condition and trend throughout the following analysis. The Stony Foothills range site is predominately a pinyon/juniper vegetation association and was assigned a PNC rating.

RANGE SITE SIMILARITY AND TREND RATINGS AND VEGETATION OBJECTIVES	
Seral Rating	**% Similarity to the Potential Natural Plant Community (PNC)**
Potential Natural community (PNC)	76-100% composition of species in the PNC
Late-Seral	51-75% composition of species in the PNC
Mid-Seral	26-50% composition of species in the PNC
Early-Seral	0-25% composition of species in the PNC
Trend Rating	**Direction of Change from the Potential Plant Community**
⇑	Improving Condition
⇔	Community Stable or No Change Evident
⇓	Community Plant Composition Declining from Potential
Vegetation Objectives	**Goal for Current Plant Community**
Maintain	Current Management or Impacts are acceptable
Improve	Establish Goals for Vegetation Management
None	Plant Community not Conducive to Management

Cottonwood Pasture:

Cottonwood pasture is two former allotments, Cottonwood and Moonlight. This pasture contains 13,389 acres of public land. Elevations range from 5500 feet to 7000 feet.

Plant communities on the Cottonwood allotment include sage/wheatgrass bottoms, the hillside bunchgrass community, sagebrush flats and pinyon/juniper ridges. Noxious weeds are occasionally popping up on this pasture. The species of concern are the knapweeds, Canada thistle, burdock, and showy milkweed. Currently all outbreaks have been controlled.

Within the Cottonwood pasture forage plant growth is initiated approximately April 1, and ends June 1, with the last date of dependable growth May 10 (see Appendix F).

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

COTTONWOOD PASTURE ANALYSIS						
Range Site	**Condition**	**Objective**	**Trend**	**Acres**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	I	⇓	565	25	37
Badland	NA	none	NA	272	0	0
Clay Saltdesert	Mid Seral	M or I	⇔	68	20	3
Clayey Slopes	Late Seral	M	⇔	4,768	13	368
Foothill Swale	Mid Seral	M or I	⇔	101	5	21
Pinyon/Jiniper	Mature	M	⇔	5,251	25	210
Rock Outcrop	NA	none	NA	2,400	0	0
Rolling Loam	Early Seral	I	⇓	430	25	17
Rolling Loam	Mid Seral	M or I	⇔	103	8	13
Rolling Loam	Mid Seral	I	⇓	104	8	13
Salt Desert Breaks	Mid Seral	M or I	⇔	53	20	3
Stony Foothills	PNC	none	⇔	25	0	0
Torifluvents	Mid Seral	none	⇔	204	0	0
TOTALS				14344		685

Analysis of the Cottonwood pasture identified 33% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 86% of the acreage and carrying capacity. Non-productive range sites make up 20% of the pasture (by acreage). Approximately 7% of the pasture is in early seral and declining trend. These plant communities are located in the drainages of Cottonwood creek with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of a combination of factors including; overstocking based on the difference between the current preference of 1340 AUMs and the estimated carrying capacity of 671 AUMs; past management which allowed late growing season grazing use; the location of water sources, and disturbances from oil and gas development. Mid seral communities make up 4% of the pasture.

Lower Horse Draw Pasture:

Lower Horse Draw pasture contains 10,002 acres of public land. Lower Horse Draw is an upland pasture, without the broad drainage bottoms of Cottonwood pasture. Elevations range from 5,500 to 6,250 feet.

Major vegetation types include hillside bunchgrass, pinyon/juniper, greasewood bottoms and sagebrush parks. Noxious weeds are rarely found on this pasture. All known locations have been controlled. Problem noxious weeds have been spotted knapweed, Canada thistle and showy milkweed. There are localized areas, around waters, which do not have appropriate accumulations of litter.

Within the Lower Horse Draw pasture forage plant growth is initiated approximately April 1, and ends June 1, with the last date of dependable growth May 10 (Appendix 7).

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

LOWER HORSE DRAW PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	⇔	283	I	**25**	11
Clayey Slopes	Late Seral	⇔	3,836	M	**13**	296
Foothill Swale	Early Seral	⇔	172	I	**10**	18
Pinyon/Jiniper	Mature	⇔	1848	M	**25**	74
Rock Outcrop	NA	NA	924	none	**0**	0
Rolling Loam	Mid Seral	⇔	692	M or I	**8**	87
Rolling Loam	Early Seral	⇓	604	I	**8**	75
Stony Foothills	PNC	⇔	1638	none	**0**	0
Torifluvents	Mid Seral	⇔	5	none	**0**	0
T0TALS			10,002			561

Analysis of the Lower Horse Draw pasture identified 38% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 66% of the acreage and carrying capacity. Non-productive range sites make up 26% of the pasture (by acreage). Approximately 6% of this pasture is in early seral or declining trend. These plant communities are located along the Dragon Trail and Moon Canyon sheep pasture with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of; overstocking based on the difference between the current preference of 680 AUMs and the estimated carrying capacity of 526 AUMs; the location of water sources, and disturbances from oil and gas development. Mid seral communities make up 7% of the pasture.

Water Canyon Pasture:

This pasture contains 23,122 acres of public land. Elevations range from 5650 feet to 7100 feet. Plant communities include sage/wheatgrass bottoms, greasewood bottoms, hillside bunchgrass, sagebrush flats and pinyon juniper ridges. Noxious weeds are rarely found on this pasture. All known locations have been controlled. Problem noxious weeds have been Canada thistle.

Within the Water Canyon pasture forage plant growth is initiated approximately April 1, and ends June 15 with the last date of dependable growth June 1.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

WATER CANYON PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	⇔	507	I	25	20
Clayey Slopes	Late Seral	⇔	9,021	M or I	13	697
Foothill Swale	Early Seral	⇔	535	I	5	109
Loamy Slopes	Mid Seral	⇔	21	M or I	8	3
Pinyon/Jiniper	Mature	⇔	6,882	M	25	275
PJ Burn & Seed	Young	⇑	1,000	M	8	125

WATER CANYON PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Rock Outcrop	NA	NA	3,300	none	0	0
Rolling Loam	Mid Seral	⇓	242	I	8	30
Stony Foothills	Mid Seral	⇔	1,243	none	0	0
Torifluvents	Mid Seral	⇑	371	none	0	0
TOTALS			23,122			1,259

Analysis of the Water Canyon pasture identified 39% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 87% of the acreage and carrying capacity. Non-productive range sites make up 21% of the pasture (by acreage). Approximately 6% of this pasture is in early seral or declining trend. These plant communities are located along the in the bottoms of drainages, and along the Dragon Trail with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of a combination of factors including; overstocking based on the difference between the current preference of 3,360 AUMs and the estimated carrying capacity of 1,259 AUMs; past management which allowed late growing season grazing use; the location of water sources, and disturbances from oil and gas development. Mid seral communities make up 8% of the pasture.

Texas Creek Pasture:

This is the largest pasture on the allotment. This pasture contains 64,894 acres of public land. Elevations range from 6000 feet to 8400 feet. This pasture is composed of canyonlands, mountainous terrain and broad valleys. The broad valleys are located in the Texas Creek drainages. Because of the size of this pasture, for discussion purposes, this pasture has been divided into three units the West, East, and North.

Plant communities include sagebrush/greasewood/wheatgrass bottoms, desert shrub hillsides, sagebrush flats, pinyon/juniper ridges, and Douglas-fir hillsides. This pasture is composed of canyon lands, mountainous terrain and broad valleys. The broad valleys are located in the Texas Creek and headwaters of Cottonwood drainages.

West Texas Creek Pasture:

The west side of Texas Creek Pasture is identified as the area on which wild horses concentrate creating serious soil and vegetation impacts. Overuse of the Texas Creek Pasture by horses is documented in the Gather Plans and Environmental Assessments completed in 1996 and 1998. Wild horse impacts were also documented in the Environmental Assessment for the Allotment Management Plan for Twin Buttes Ranch and Section 8 report.

Plant communities include sagebrush/greasewood/wheatgrass bottoms, desert shrub hillsides, sagebrush flats, pinyon/juniper ridges, and Douglas-fir hillsides. On the lower elevations of the Texas Creek pasture forage plant growth is initiated approximately April 15 and ends June 5, with the last date of dependable growth May 20 (Appendix 7). On the upper elevations around Texas mountain forage plant growth is initiated approximately May 15, and ends August 15, with the last date of dependable growth July 21.

As stated earlier the vegetation problems described here are almost exclusively the result of overuse by wild horses.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

WEST TEXAS PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	⇔	118	I	18	7
Badlands	NA	NA	115	none	0	0
Brushy Loam	Late Seral	⇔	304	M	12	25
Clayey Slopes	Late Seral	⇔	5,431	M	10	554
Deep Loam	Late Seral	⇔	383	M	4	96
Deep Loam	Mid Seral	⇔	27	M or I	6	5
Dry Exposure	PNC	⇑	76	M	10	8
Foothill Swale	Early Seral	⇔	671	I	10	70
Foothill Swale	Mid Seral	⇔	40	M or I	5	8
Foothill Swale	Mid Seral	⇓	270	I	5	54
Pinyon Juniper	Mature	⇔	7,660	M	25	306
Rock Outcrop	NA	NA	2,162	none	0	0
Rolling Loam	Early Seral	⇔	81	I	13	6
Rolling Loam	Late Seral	⇔	133	M	4	32
Rolling Loam	Mid Seral	⇔	201	M or I	6	32
Spruce Fir	Mature	⇔	617	M	20	31
Stony Foothills	PNC	⇔	1,092	none	0	0
Torrifluvents	Early Seral	⇔	232	none	0	0
TOTALS			19613			1233

Analysis of the West Texas Creek pasture identified 32% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 79% of the acreage and carrying capacity. Non-productive range sites make up 18% of the pasture (by acreage). Approximately 6% of this pasture is in early seral or declining trend. These plant communities are located along the in the bottoms of the Texas Creek basin which is an arid area with plant communities that are easily damaged and slow to recover. Season long grazing by wild horses has affected these plant communities by changing vegetation composition to types that are grazing tolerant, unproductive or unpalatable. One conversion has been to an annual forbs and grass community. These annual communities complete their life cycle early in the year before the available moisture has become limiting. This has the affect of decreased opportunity for vegetation production, which is valuable for forage and litter. Excessive grazing has also resulted in grazing tolerant vegetation communities consisting of blue grama, galletta and snakeweed which are expanding in the area. Blue grama in particular, is an indicator of grazing use occurring too late into the growing season. The projected scenario by which blue grama has increased in the Texas Creek basin is; cool season grasses are grazed through the growing season and are unable to fulfill their phenological requirements of growth, reproduction and carbohydrate storage. Subsequently the cool season grasses are replaced by warm season grasses which grow in response to late summer showers. The climate of NW Colorado generally has more reliable moisture during the winter and spring than the summer. A conversion to warm season grasses dependant on less reliable summer precipitation creates a scenario of decreased and unreliable forage production. These plant communities lack of resilience which when coupled with continual horse use which maintains a degraded and unproductive condition. There are also large horse trails crossing the bottoms of Texas Creek. The size and depth of these horse trails prevents overland flow of water by gathering the water onto the trails and funneling the water off site making this moisture unavailable for vegetation. Several of the horse trails now function as drainages with active headcuts. Because of the

limited forage resources, wild horses have and will increase their range to procure forage, degrading additional areas. Because of the degraded rangeland conditions Twin Buttes Ranch has significantly decreased their grazing use of this area. The analysis of available forage indicates forage production is in line with the current grazing preference, approximately 1,200 AUMs.

East Texas Creek Pasture:

The East Texas pasture is mountainous with the primary vegetation being pinyon/juniper woodland. Several ridges have been chained to remove the pinyon /juniper overstory and increase forage.

Vegetation problems in Little Horse Draw and West Douglas Creek are the result of livestock grazing both period of use (growing season long) and intensity (Utilization often exceeds 80%).

Within the Texas Creek pasture forage plant growth is initiated approximately April 15, and ends June 1, with the last date of dependable growth May 20 (Appendix 5). On the upper elevations around Texas mountain forage plant growth is initiated approximately May 15, and ends August 15, with the last date of dependable growth July 21.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

EAST TEXAS PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	⇔	240	I	18	13
Clayey Slopes	Late Seral	⇔	4,802	M	10	490
Clayey Slopes	Late Seral	⇔	834	M	10	85
Deep Loam	Late Seral	⇔	263	M	4	66
Foothill Swale	Early Seral	⇔	353	I	10	37
Foothill Swale	Mid Seral	⇔	320	M or I	5	64
Pinyon Juniper	Mature	⇔	8,381	M	25	335
PJ Chaining	Young	⇑	1,150	M	8	144
Rock Outcrop	NA	NA	2,395	none	0	0
Rolling Loam	Mid Seral	⇔	20	M or I	6	3
Spruce Fir	Mature	⇔	331	M	20	17
Stony Foothills	PNC	⇔	1,507	none	0	0
Torrifluvents	Mid Seral	⇑	145	none	0	0
TOTALS			20741			1254

Analysis of the East Texas pasture identified 30% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 86% of the acreage and carrying capacity. Non-productive range sites make up 19% of the pasture (by acreage). Approximately 3% of the pasture is in early seral condition. These plant communities are located in the drainages of Little Horse and West Douglas with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of a combination of factors including; intense use related to trailing livestock, the location of water sources, and disturbances from oil and gas development. Horses make use of the chainings and below Texas mountain. Localized overuse has

been found on these areas. The analysis of available forage indicates forage production is in line with the current grazing preference, approximately 1,200 AUMs.

North Texas Creek Pasture:

This portion of the Texas Creek pasture is managed more in association with the Cottonwood and Water Canyon Pastures. This area contains 20,741 acres of public land and 2,495 acres of private land.

Plant communities include sage/wheatgrass bottoms, the hillside bunchgrass community, sagebrush flats and pinyon/juniper ridges. A large pinyon/juniper wildfire occurred in this pasture in June of 2000, this wildfire was seeded and reclamation is proceeding as expected. Few noxious weeds have been reported or treated in this pasture. The species of concern are the knapweeds, Canada thistle, burdock, and showy milkweed.

Within this pasture forage plant growth is initiated approximately April 1, and ends June 1, with the last date of dependable growth May 10 (Appendix 7).

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

NORTH TEXAS PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Late Seral	⇔	37	M	8	4
Badlands	NA	NA	54	none	**0**	0
Brushy Loam	Late Seral	⇔	4	M	**12**	0
Clayey Foothills	Late Seral	⇔	20	M	**6**	3
Clayey Slopes	Late Seral	⇔	5,923	M	**13**	457
Clayey Slopes	Mid Seral	⇔	587	M or I	15	38
Foothill Swale	Early Seral	⇔	190	I	10	20
Foothill Swale	Mid Seral	⇔	74	M or I	**5**	15
Loamy Slopes	Mid Seral	⇔	85	M or I	**8**	11
Pinyon Juniper	Mature	⇔	5,080	M	**25**	203
PJ 1974 Burn	Young	⇑	1,100	M	**8**	138
Rock Outcrop	NA	NA	2,538	none	**0**	0
Rolling Loam	Early Seral	⇔	553	I	32	17
Rolling Loam	Mid Seral	⇔	1,394	M or I	**8**	174
Stony Foothills	PNC	⇔	162	none	**0**	0
Torrifluvents	Early Seral	⇔	88	none	**0**	0
TOTALS			17889			1081

Analysis of the North Texas Creek pasture identified 33% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 77% of the acreage and carrying capacity. Non-productive range sites make up 16% of the pasture (by acreage). Approximately 5% of this pasture is in early seral condition. These plant communities are located along the in the bottoms of drainages, and along the Dragon Trail with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of the location of water

sources, and disturbances from oil and gas development. Mid seral plant communities make up 12% of the pasture. The analysis of available forage indicates forage production is in line with the current grazing preference, approximately 1,100 AUMs.

West Creek Pasture:

The portion of West Creek pasture within the planning area contains 7,229 acres of public land and 344 acres of private land. Elevations range from 6,500 feet to 8,700 feet. Plant communities include; mountain shrub hillsides, pinyon/juniper ridges, and Douglas-fir slopes. On Texas mountain there have been outbreaks of spotted and Russian Knapweed. Both of the outbreaks appear to be related to oil and gas development. These outbreaks have been treated and are now under monitoring status.

Within the West Creek pasture forage plant growth is initiated approximately June 1, and ends September 10, with the last date of dependable growth August 21.

Analysis of Standard 3 - Plant Component

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

West Creek PASTURE ANALYSIS (HERD AREA ONLY)							
Range Site	**Condition**	**E**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	H	⇔	67	I	18	4
Brushy Loam	Late Seral	H	⇔	132	M	12	11
Brushy Loam	Mid Seral	H	⇔	302	M or I	21	14
Clayey Slopes	Mid Seral	H	⇔	1756	M or I	10	176
Deep Loam	Late Seral	H	⇔	83	M	4	21
Dry Exposure	PMC	H	⇑	73	M	10	7
Foothill Swale	Early Seral	H	⇔	99	I	10	10
Foothill Swale	Mid Seral	H	⇔	100	M or I	5	20
Loamy Slopes	Late Seral	H	⇔	246	M	5	49
Pinyon/Jiniper	Mature	H	⇔	2076	M	25	83
Spruce Fir	Mature	H	⇔	248	M	20	12
Stony Foothills	PNC	H	⇔	1167	none	0	0
Rock Outcrop	NA	H	NA	878	none	0	0
TOTALS				7227			408

Analysis of the West Creek pasture identified 6% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 47% of the acreage and carrying capacity. Non-productive range sites make up 28% of the pasture (by acreage). Approximately 2% of the pasture is in early seral condition. These plant communities are located in the drainages of West Creek and Texas Draw with vegetation composed of cheatgrass and annual forbs. These early seral communities are the result of a combination of factors including; season long grazing by wild horses and intensive grazing by livestock, the location of water sources, and disturbances from oil and gas development. Horses make use of the area between Texas mountain and Oil Spring Mountain. Localized overuse has been found on these areas. The analysis of available forage indicates forage production is in line with the current grazing preference, approximately 400 AUMs.

Park Pasture:

The Park pasture contains 920 acres of public land and 1,000 acres of private land. Elevations range from 6,400 feet to 6,700 feet. Plant communities include sage/wheatgrass flats, hillside bunchgrass, and pinyon juniper ridges.

Overall this pasture is in relatively good condition. Cheatgrass is present but does not dominate the plant communities. There are scattered bull thistles but they do not appear to be expanding. Removal of 24 horses from this pasture in 1998 has allowed forage plants the opportunity to regrow following grazing.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

PARK PASTURE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Badlands	NA	NA	65	None	0	0
Clayey Slopes	Late Seral	⇔	276	M	13	21
Clayey Slopes	Mid Seral	⇔	11	M or I	14	1
Foothill Swale	Mid Seral	⇔	39	M or I	5	8
Pinyon Juniper	Mature	⇔	290	M	25	12
Rock Outcrop	NA	NA	138	None	0	0
Rolling Loam	Late Seral	⇔	40	M	5	7
Stony Foothills	PNC	⇔	23	none	0	0
TOTALS			882			49

Water Hole Pasture:

The Water Hole Pasture contains 42 acres of public land and 643 acres of private land. Elevations range from 6,200 feet to 6,400 feet. Plant communities include sage/wheatgrass flats, hillside bunchgrass, and pinyon juniper ridges. There are currently 4-6 horses using this pasture with all of the use occurring on private lands. The 42 acres of public land within this pasture is not suitable for grazing and are unaffected by grazing animals.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

WATER HOLE ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Late Seral	⇔	1	M	8	0
Clayey Slopes	Late Seral	⇔	12	M or I	13	1
Pinyon Juniper	Mature	⇔	14	M	25	1
Rock Outcrop	NA	NA	7	none	0	0
Rolling Loam	Mid Seral	⇔	7	M or I	8	1
TOTALS			41			3

Bull Draw Allotment:

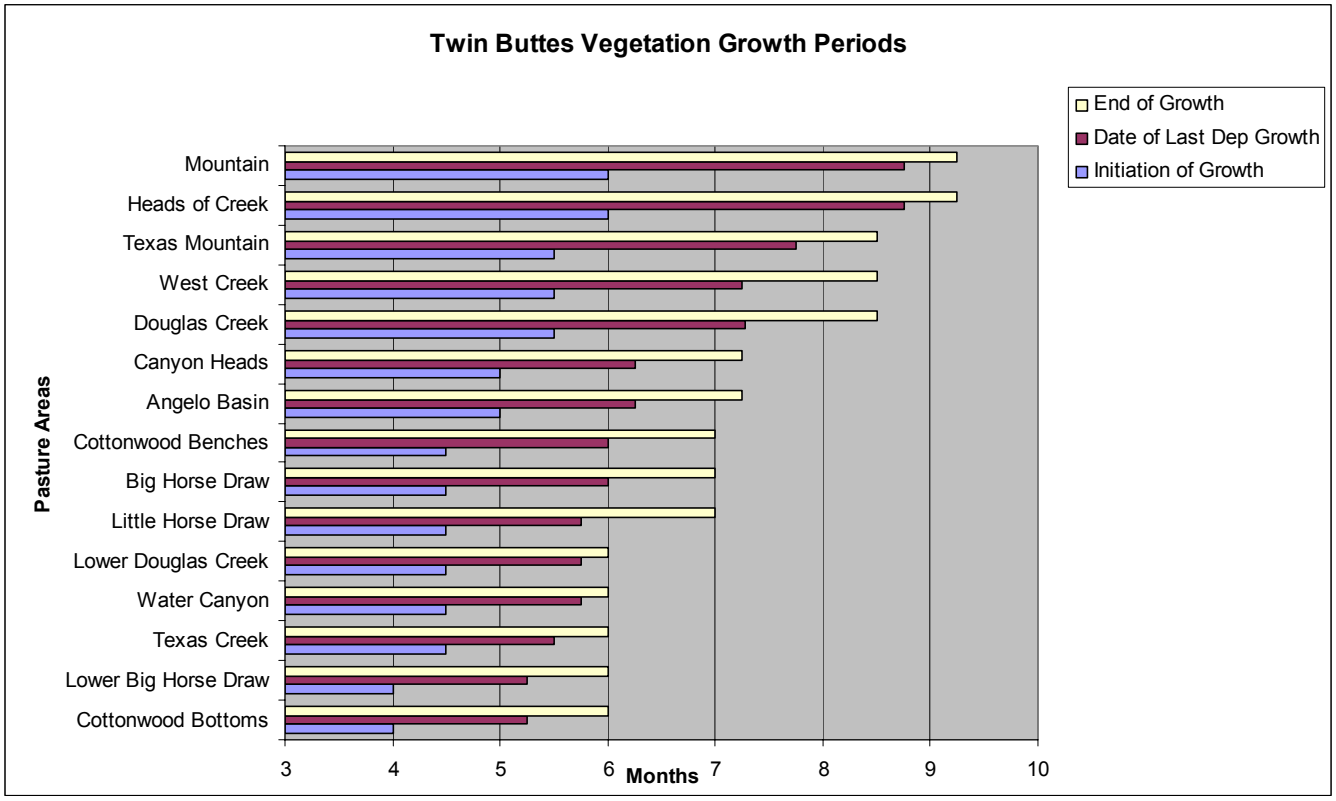
The Bull Draw allotment is managed as a pasture of the East Douglas Creek allotment. The East Douglas Creek allotment is located East of the Herd Area. Bull Draw contains 9523 acres of public land and 20 acres of private land. Elevations range from 6100 to 7100 feet. Plant communities include sage/wheatgrass bottoms, greasewood bottoms, hillside bunchgrass, sagebrush flats and pinyon juniper ridges. Noxious weeds are rarely found on this pasture. Within the Bull Draw allotment forage plant growth is initiated approximately April 1, and ends June 15 with dependable growth ending June 1st.

The following tables show an estimate of the public land acreage falling within one of the seral ratings for each range site on each allotment and the vegetation trend.

BULL DRAW ANALYSIS						
Range Site	**Condition**	**Trend**	**Acres**	**Objective**	**Acres/AUM**	**AUMs**
Alkaline Slopes	Early Seral	⇑	203	M or I	25	8
Alkaline Slopes	Mid Seral	⇑	200	M	13	16
Clayey Slopes	Late Seral	⇔	3,147	M	13	243
Foothill Swale	Early Seral	⇑	125	M or I	10	13
Foothill Swale	Mid Seral	⇑	28	M	5	6
Pinyon/Jiniper	Mature	⇔	3,234	M	25	129
Rock Outcrop	NA	NA	1,505	none	0	0
Stony Foothills	Mid Seral	⇔	965	none	0	0
Torifluvents	Mid Seral	⇑	119	none	0	0
TOTALS			9526			415

Analysis of the Bull Draw allotment identified 33% of the pasture as in late seral condition. These range sites are on uplands intermingled with the pinyon/juniper and rock outcrops, which in total make up 83% of the acreage and carrying capacity. Non-productive range sites make up 27% of the pasture (by acreage). Approximately 3% of this pasture is in early seral. These plant communities are located in the bottoms of Bull, Little Bull and Little Indian drainages, with vegetation composed of cheatgrass and annual forbs. The problems with the indicators are the result of past grazing management. Specifically the allotment **was** overstocked, and grazed during the growing season, which did not allow for the growth requirements of the forage plants. A grazing program was initiated in 1990, which decreased livestock numbers and the period of use. Throughout the allotment, vegetation condition has been improving. An analysis of the carrying capacity showed the potential for increased livestock use based on the current preference of 187 AUMs and the estimated carrying capacity of 422 AUMs.

APPENDIX G: Twin Buttes Growth Chart



Appendix H: POPULATION MODELING, WEST DOUGLAS HERD AREA

Version 1.40 of the WinEqqus program, created April 2, 2002, was used to complete a population modeling exercise for each alternative that maintains horses in West Douglas (Alternatives C; E; F; G). A description of the model is included later in this appendix.

The initial age structure of the West Douglas herd was derived from data collected during the 2001 West Douglas gather (the most recent removal). The age and sex of each horse captured during the 2001 gather was tabulated. This data was pro-rated using the WinEqqus program to the mid-point management number of each alternative and used to estimate the age structure and sex ratio that could be expected following implementation of each alternatives. The following table displays the 2001 gather data utilized to pro-rate populations of the alternatives:

Age Class	West Douglas Initial Age Structure 2001	
	Females	Males
Foals	4	10
1	1	5
2	5	4
3	2	1
4	5	2
5	0	0
6	0	0
7	0	0
8	1	1
9	1	0
10-14	5	4
15-19	0	0
20+	0	1

The age selective criteria of removing horses captured in the target age groups of 0 to 5 years and 10 to 20 years of age was entered into the model for each management alternative. 100% of the captured horses of the target age groups were identified for removal, working on the premise that 80% of the herd can be trapped.

Removal Criteria utilized with Population Modeling	Percentages targeted for removals (assuming 80% of the herd is captured)	
	Females	Males
Foal	100%	100%
1	100%	100%
2	100%	100%
3	100%	100%
4	100%	100%
5	100%	100%
6	0	0
7	0	0
8	0	0
9	0	0
10-14	100%	100%
15-20	100%	100%
20+	0	0

The model asked for the minimum age of sanctuary-bound wild horses. This question was defaulted to "not applicable" since only the target age groups of 6 to 9 years and horses over 20 years are targeted for

return into the herd. (Given the young age structure of this herd, there will likely be few horses over 20 years returned into their range.)

Herd survival probabilities and foaling rate per age class of mare is not available for the West Douglas herd. This data was defaulted to Pryor Mountain herd data contained in the population model.
Pryor Mountain herd survival probabilities and foaling rates are summarized in the following table.

Survival Probabilities and Foaling Rates Utilized for
West Douglas Population Modeling

Age Class	Survival Probabilities		Foaling Rates
	Females	Males	
Foals	.919	.877	--
1	.996	.950	--
2	.994	.949	.52
3	.993	.947	.67
4	.990	.945	.76
5	.988	.942	.89
6	.985	.939	.76
7	.981	.936	.90
8	.976	.931	.88
9	.971	.926	.91
10-14	.947	.903	.81
15-19	.870	.830	.82
20	.591	.564	.75

The following summarizes differences between the variables entered for each alternative:

Alternative C; AML range of 29 to 60; Midpoint 42; Fertility Control not used

Horses are captured when the population reaches 60 head (the threshold population size). The herd is lowered to 29 horses (the target population size).
Fertility control is not used to regulate population growth.

Alternative E and F; 100 to 207 Horses; Mid-point 144; Fertility Control Alternatives
The threshold population size for gathers is 207 horses.
The target population for each alternative is 100 horses.
Gathers for fertility control treatment only occur if population exceeds threshold population size.
Gathers do not continue after removals to treat additional females to be released.
100% of the captured mares between 6 and 9 years of age are treated with the fertility control agent.

Alternatives G, 310 to 643 Horses; Mid-point 447; Fertility Control Alternative
The threshold population size for gathers is 643 horses.
The target population is 310 horses.
Gathers for fertility control treatment only occur if population exceeds threshold population size.
Gathers do not continue after removals to treat additional females to be released.
100% of the captured mare between 6 and 9 years of age are treated with the fertility control agent;

Population Modeling Summary
Review of the data output for each of the completed simulations provided comparisons of possible outcomes for each alternative. The following comparisons are made for each alternative analyzed:

- Do any of the alternatives “crash” the population?
- What effect does fertility control have on population growth rate?
- What effects do the different alternatives have on the average population size?

Population size in twenty years

Each alternative was simulated using 100 trials over a 20 year time period from 2005 to 2025 (the maximum number of years allowed by the program) and gave output through 2025. Out of the 100 trials in each simulation run, the model tabulated minimum, average (most typical) and maximum population sizes. These numbers allow relative comparisons of the different alternatives, and potential outcomes under different management options. This analysis weighs both demographic and environmental factors. The following compares the results of this exercise, and are listed by management alternative.

Minimum Population Sizes in 21 years

Alternative	**C**	**E and F**	**G**
Lowest Trial	1	42	139
10th Percentile	16	66	194
25th Percentile	21	84	238
Median Trial	**26**	**94**	**290**
75th Percentile	29	106	322
90th Percentile	32	112	348
Highest Trial	37	125	383

This table reflects the lowest population levels that may be expected over a 20 year span of time for each alternative. Alternative C has the least number of 0-20 year old horses, with the lowest population ever obtained a sobering stat of "1"animal. The probability of the herd falling below the low end of the AML to as low as 1 horse is a valid concern. The "crash" indicated in alternative C would not be caused by a continued loss of genetic variation but, rather; indicates sudden mortality of horses due to unforeseeable, critical environmental occurrences and/or the population being unable to maintain the recruitment levels needed to offset natural mortality.

The level to which the population is gathered (low end of the AML) appears to be more influential on herd size than the influence of fertility control. The wide variations in population size between each trial in alternatives E and F suggests that fertility control targeted for only captured horses between 6 and 9 years will not effectively control herd increases.

Population Sizes in 20 years – Most Typical

Alternative	**C**	**E and F**	**G**
Lowest Trial	10	71	226
10th Percentile	35	119	366
25th Percentile	40	139	431
Median Trial	**45**	**151**	**482**
75th Percentile	49	163	511
90th Percentile	53	174	542
Highest Trial	61	187	595

This table displays the average, or most typical, population sizes obtained during the 100 trials run for each alternative over a 20 span of time. The average population size across five years ranged from a low of 10 in Alternative C to a high of 595 in Alternative G. Alternative C reflects the lowest overall average of all four alternatives. Alternative E and F are the second lowest, followed by G. In each alternative, the average median population sizes at the time of gather are slightly above the mid-point AML. This suggests that management practices included in this alternative would result in maintenance of a herd that is close to the AML range identified in alternatives E and F. The population model did not detect any management practices in this alternative that would crash the population or cause the population to far exceed the AML range of alternatives E and F. It is worth noting that the use of fertility control in alternatives E and F is not consequential enough to be noticed, (the median trial shows a herd of 151 horses – above the mid-range AML of 144 and in keeping with the percent above AML seen in alternatives C and G.) The herd sizes estimated for this alternative suggests treating only the mares captured in the target mid-age groups will not be an effective tool to moderate herd increase.

Population Sizes in 20 years - Maximum

Alternative	C	E and F	G
Lowest Trial	52	152	632
10th Percentile	62	214	656
25th Percentile	68	226	728
Median Trial	**77**	**258**	**792**
75th Percentile	85	285	878
90th Percentile	94	324	981
Highest Trial	125	382	1129

This table displays the largest herd sizes the population model estimates based on 100 trials over 20 years for each alternative. The median of each of these alternatives is greater than the estimated pre-gather herd size for each alternative. Again, the use of fertility control of only the captured target animals does not appear to effectively impact population increase.

Time Series Graph (available upon request to WRFO)

These graphs display population size changes over a 20 year span for each trial. Each line represents one of the 100 trials for the simulations completed for each alternative. The two horizontal lines located in the graphs represent the threshold for gather and the target population size. Three graphs are presented for each alternative: Trials with the Highest Population size; Trials with the Lowest Population Size, and Most Typical Trials. The most typical trial in each alternative's graph does not necessarily echo the median trial graph. Median and typical are not synonymous with one another. A typical trial is the most likely outcome that may occur as a result of the variables included for that alternative; the median are the trials averaged with one another. It is worth noting that the most typical trial for each of the alternatives analyzed falls primarily within the threshold and target population sizes (the horizontal lines).

Average Growth Rates in 20 years

As with all of the output data obtained from the model, average growth rates were obtained from running the model for 100 trials for 20 years using the various management options itemized above for each alternative. The following table displays the results obtained from the model:

Average Growth Rate in 20 Years

Alternative	C	E and F	G
Lowest Trial	-15.5 %	-2.9 %	-2.8 %
10th Percentile	1.1 %	1.4 %	2.3 %
25th Percentile	3.6 %	3.4 %	3.7 %
Median Trial	**6.4 %**	**5.6 %**	**5.7 %**
75th Percentile	9.0 %	7.3 %	7.4 %
90th Percentile	11.6 %	8.8 %	8.7 %
Highest Trial	15.0 %	10.4 %	11.7 %

The lowest trials in each alternative reflect a negative population growth for the herd. The highest trials estimate the highest population growth estimated for the herd. The two alternatives with fertility control do not reflect any decrease in growth rate when compared with the other alternatives. The target size to which the population is gathered appears to have the greatest degree of impact on the herd growth rate. Alternative C, with the lowest range of animals managed also has the widest range of growth; from -15% to positive 15%. The average growth rate, 6.4% is the highest average of any of the alternatives. The negative trial growth rates are concerning and are, hopefully not a direct result of management options but, instead, reflective of the random nature of the model and the ability to show extremes in possible outcomes. The median growth rates are below 10% for each alternative. The highest growth rates for each alternative are less than the 20% used in this document to calculate herd increases.

Population Modeling Summary

To summarize the results obtained by simulating the range of alternatives for the West Douglas Herd Area, the original questions can be addressed.

- Do any of the Alternatives "crash" the population?

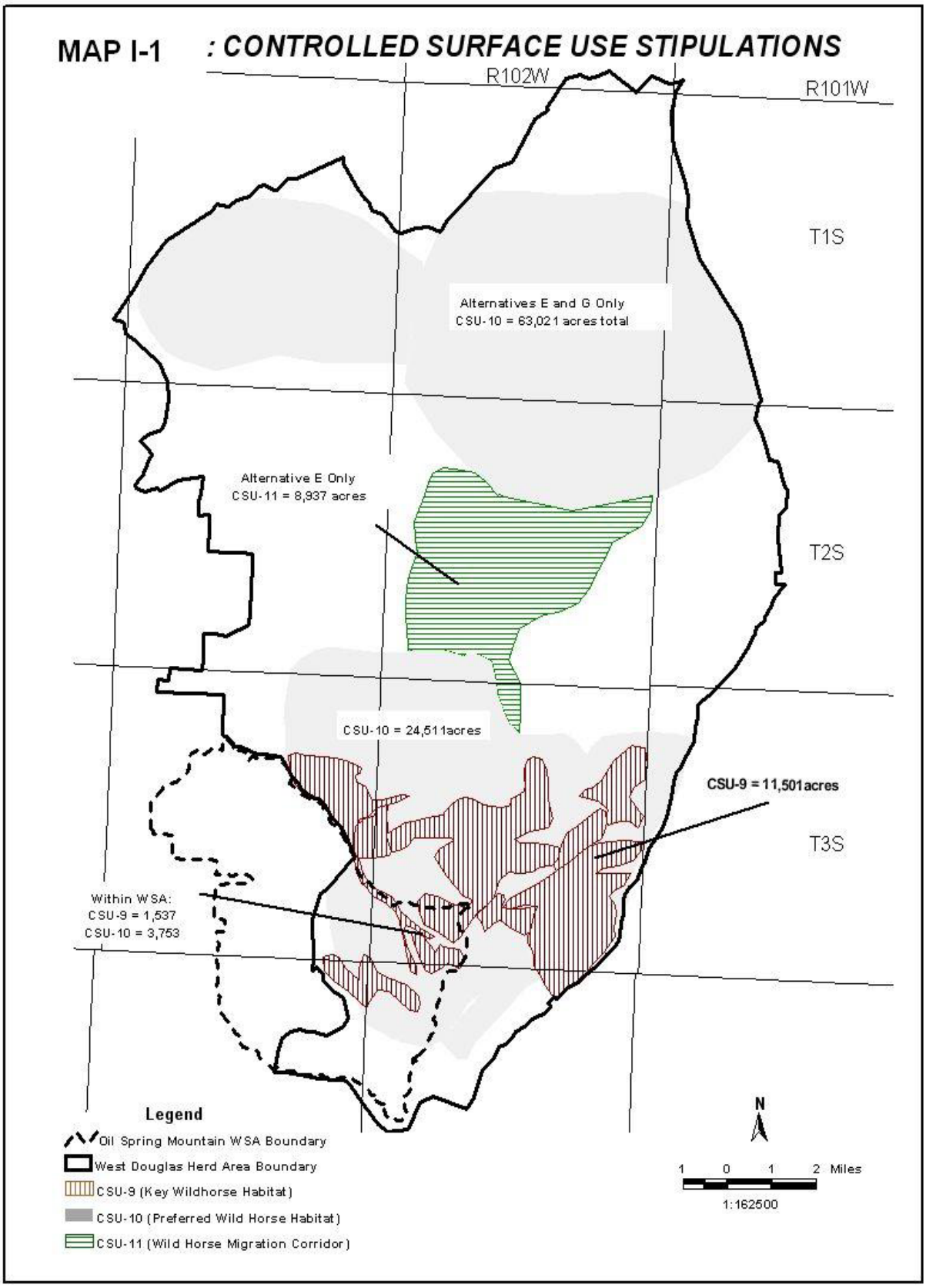
Yes. The minimum population estimate chart for Alternative C calculates a risk of the herd falling as low as "1" horse. The model estimates a 10% chance of the herd falling below 18 horses.

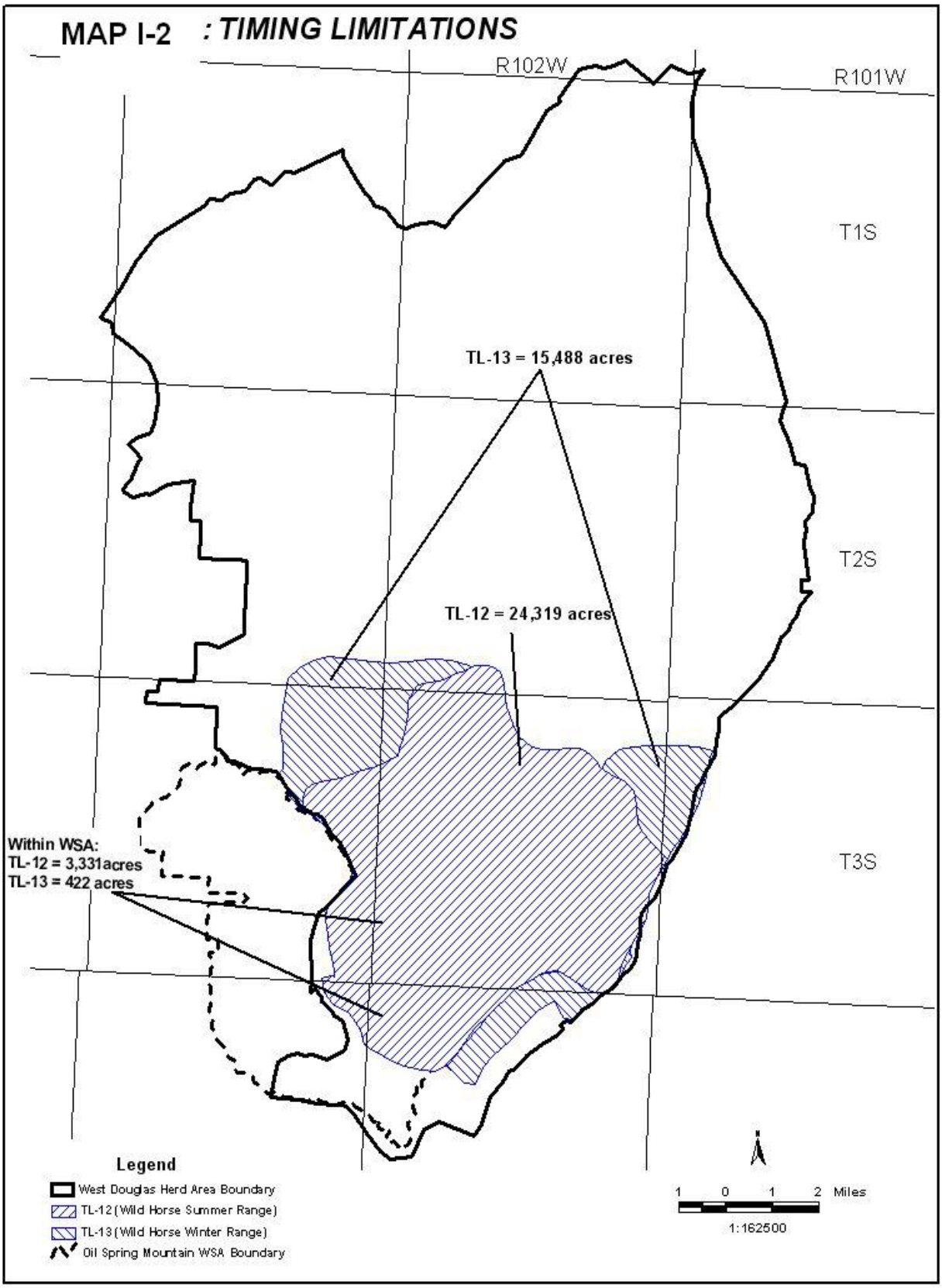
- What effect does fertility control have on population growth rate?

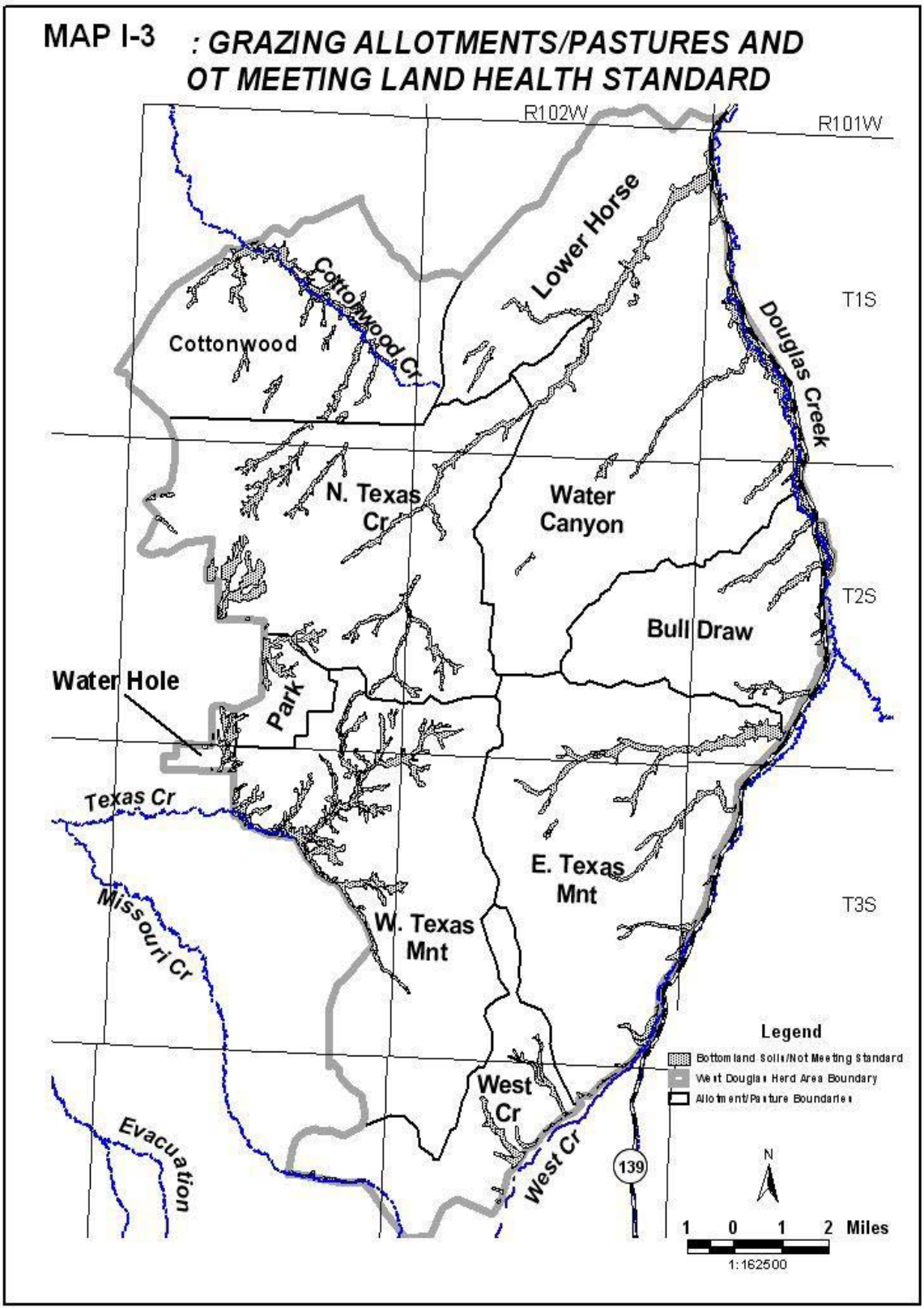
The two alternatives implementing fertility control (E and F) reflect no discernable difference in herd growth rate with the use of fertility control. The lack of effect resulting from using fertility control only on captured horses between 6 and 9 years of age is probably due to the few horses of that age and sex bracket that will be captured during removals. A more effective use of fertility control would be realized if additional mares were captured, treated and released back into the herd.

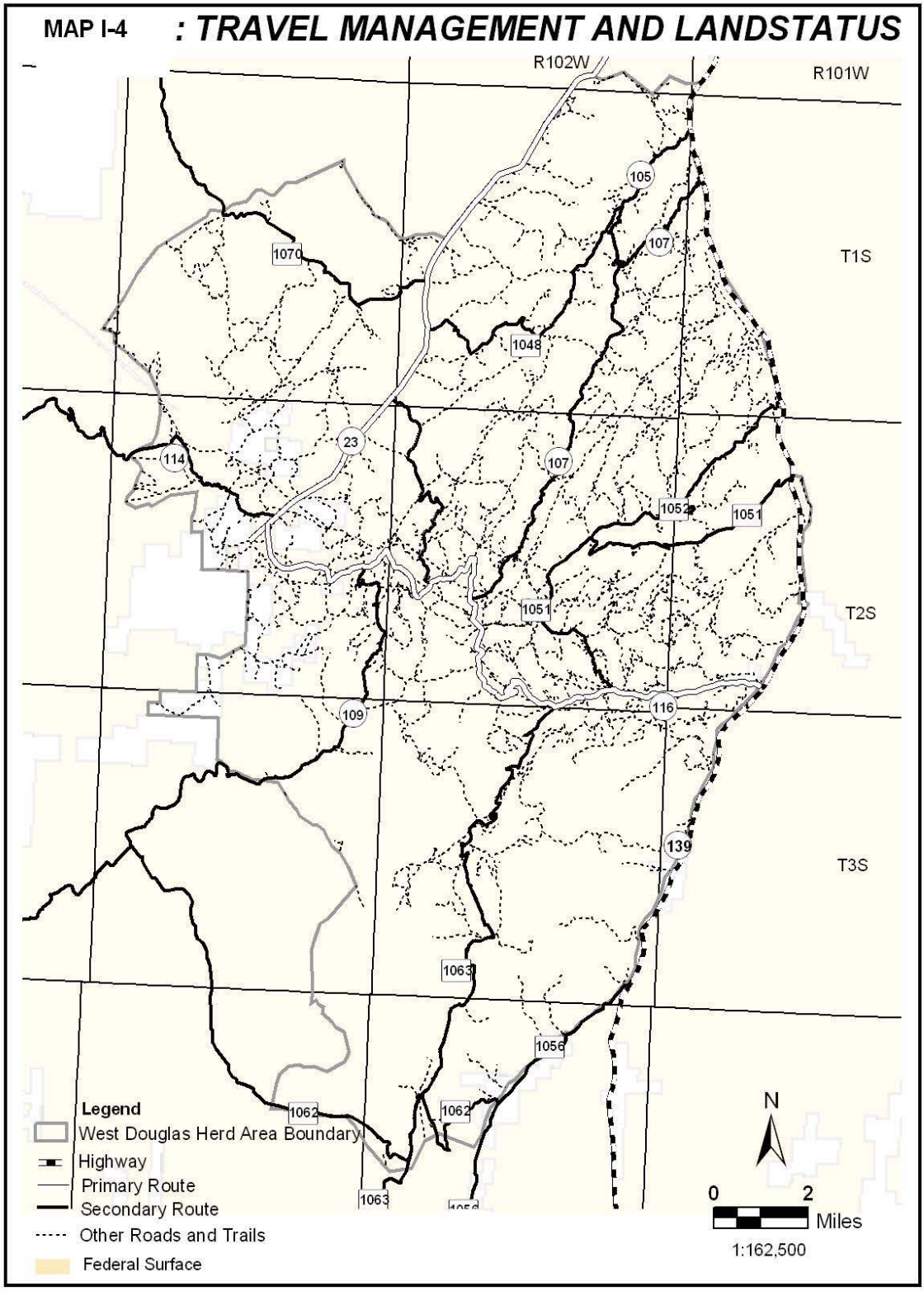
- What effect do the different alternatives have on the average population size?

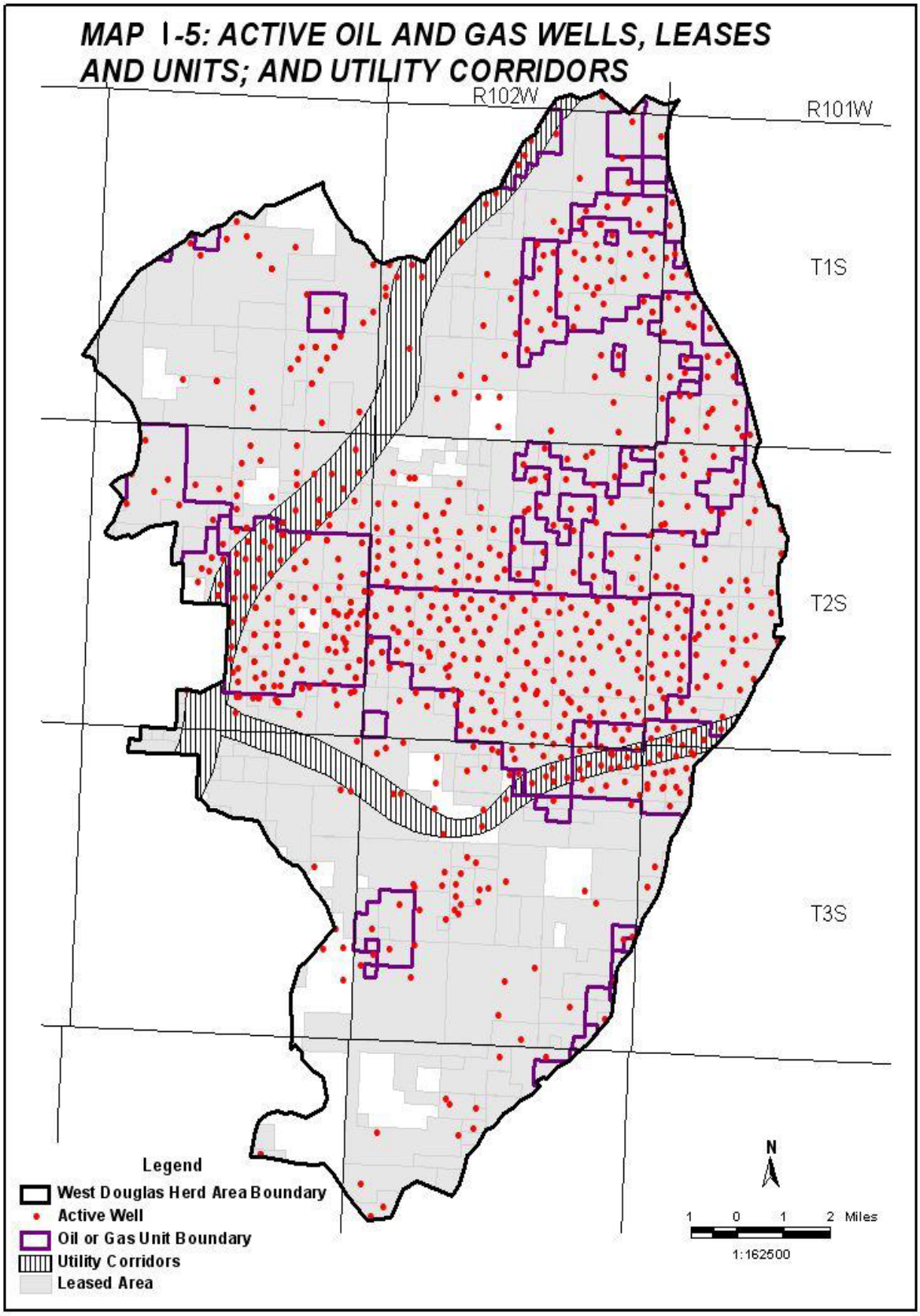
The target size to which the population is gathered (29 horses; 100 horses and 310 horses respectively) appears to impact herd growth rates and the ability of the herd to recruit animals into the population. The model shows wide fluctuation in herd growth in alternative C when the population is lowered to 29 animals.

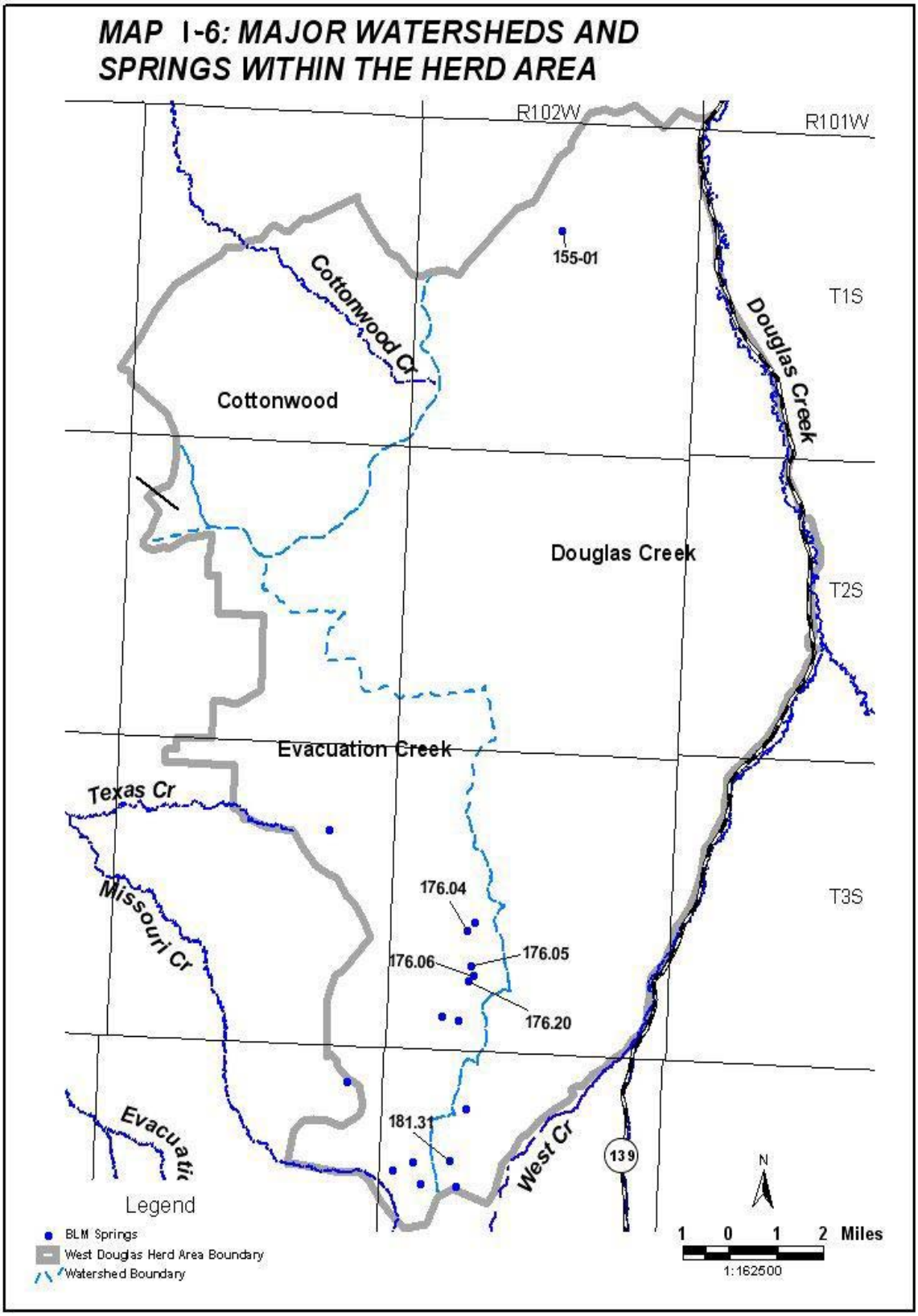

MAP I-1 : CONTROLLED SURFACE USE STIPULATIONS
R102W
R101W
T1S
T2S
T3S
Alternatives E and G Only
CSU-10 = 63,021 acres total
Alternative E Only
CSU-11 = 8,937 acres
CSU-10 = 24,511acres
CSU-9 = 11,501acres
Within WSA:
CSU-9 = 1,537
CSU-10 = 3,753
Legend
Oil Spring Mountain WSA Boundary
West Douglas Herd Area Boundary
CSU-9 (Key Wildhorse Habitat)
CSU-10 (Preferred Wild Horse Habitat)
CSU-11 (Wild Horse Migration Corridor)
N
1 0 1 2 Miles
1:162500


MAP I-2 : TIMING LIMITATIONS
R102W
R101W
T1S
T2S
T3S
TL-13 = 15,488 acres
TL-12 = 24,319 acres
Within WSA:
TL-12 = 3,331acres
TL-13 = 422 acres
Legend
West Douglas Herd Area Boundary
TL-12 (Wild Horse Summer Range)
TL-13 (Wild Horse Winter Range)
Oil Spring Mountain WSA Boundary
1 0 1 2 Miles
1:162500

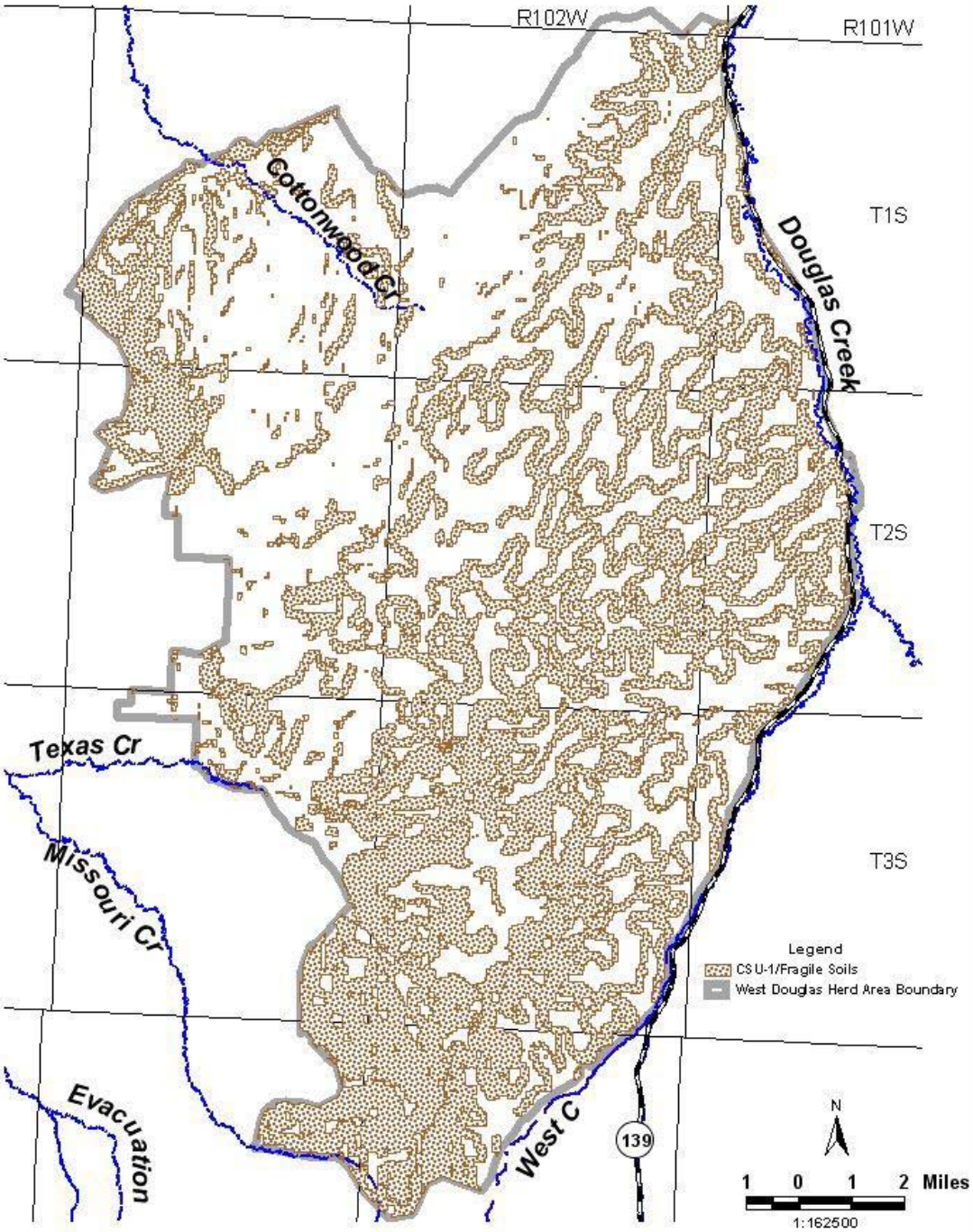

MAP I-3 : GRAZING ALLOTMENTS/PASTURES AND OT MEETING LAND HEALTH STANDARD
R102W
R101W
T1S
T2S
T3S
Cottonwood
Cottonwood Cr
Lower Horse
Douglas Creek
N. Texas Cr
Water Canyon
Bull Draw
Water Hole
Park
Texas Cr
Missouri Cr
E. Texas Mnt
W. Texas Mnt
West Cr
West Cr
Evacuation
139
Legend
Bottomland Soils/Not Meeting Standard
West Douglas Herd Area Boundary
Allotment/Pasture Boundaries
N
1 0 1 2 Miles
1:162500

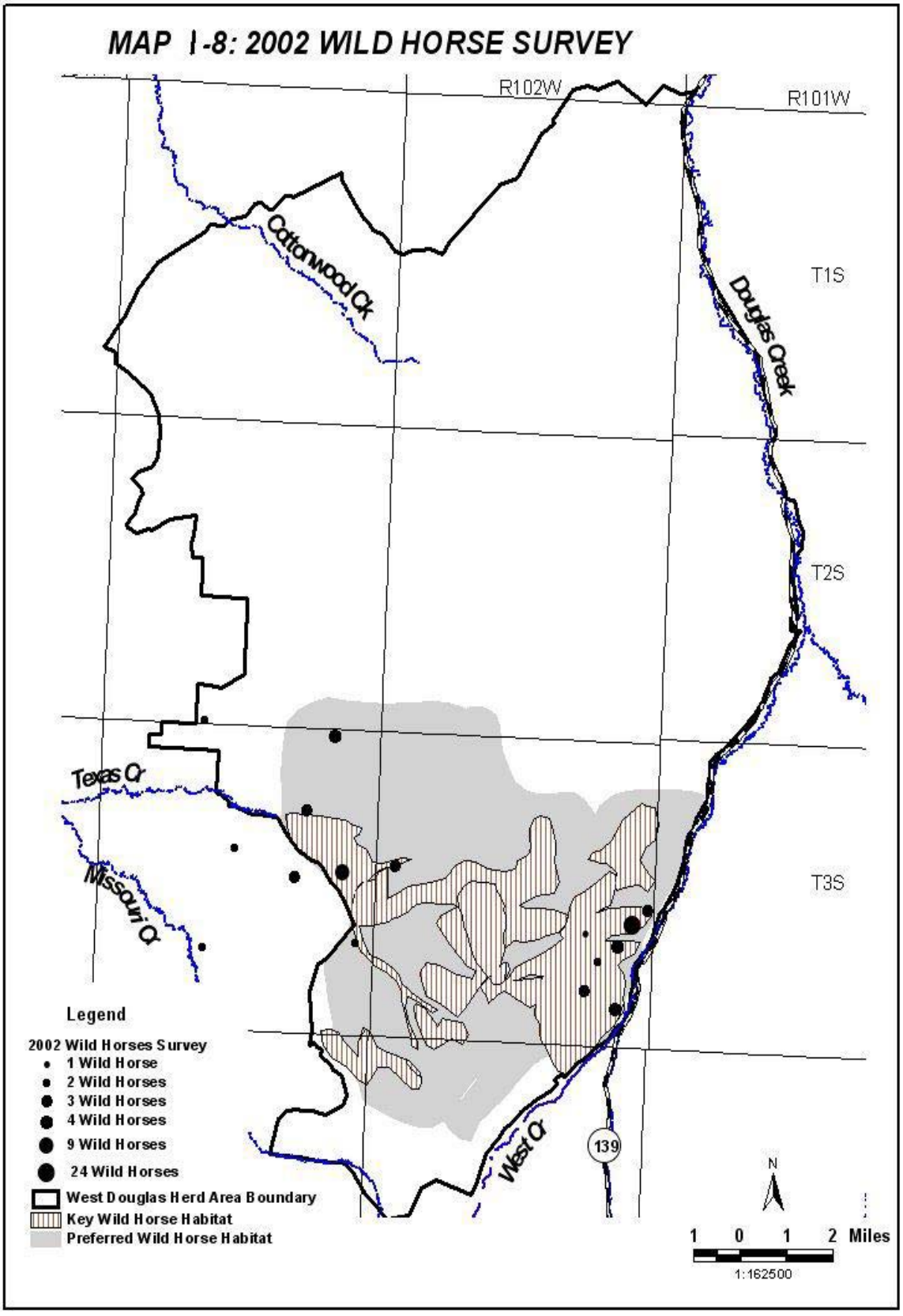

MAP I-4 : TRAVEL MANAGEMENT AND LANDSTATUS
R102W
R101W
T1S
T2S
T3S
105
107
1070
1048
23
114
107
1052
1051
1051
109
116
139
1063
1056
1062
1062
1063
Legend
West Douglas Herd Area Boundary
Highway
Primary Route
Secondary Route
Other Roads and Trails
Federal Surface
N
0
2
Miles
1:162,500


MAP I-5: ACTIVE OIL AND GAS WELLS, LEASES AND UNITS; AND UTILITY CORRIDORS
R102W
R101W
T1S
T2S
T3S
Legend
West Douglas Herd Area Boundary
Active Well
Oil or Gas Unit Boundary
Utility Corridors
Leased Area
N
1 0 1 2 Miles
1:162500


MAP I-6: MAJOR WATERSHEDS AND SPRINGS WITHIN THE HERD AREA
R102W
R101W
155-01
T1S
Cottonwood Cr
Douglas Creek
Cottonwood
Douglas Creek
T2S
Evacuation Creek
Texas Cr
Missouri Cr
176.04
176.05
176.06
176.20
T3S
181.31
West Cr
139
Evacuatic
N
Legend
BLM Springs
West Douglas Herd Area Boundary
Watershed Boundary
1 0 1 2 Miles
1:162500

Map I-7: CONTROLLED SURFACE USE STIPULATION, CSU-1; FRAGILE SOILS ON SLOPES >35 PERCENT




MAP I-8: 2002 WILD HORSE SURVEY
R102W
R101W
T1S
T2S
T3S
Cottonwood Ck
Douglas Creek
Texas Cr
Missouri Cr
West Cr
139
Legend
2002 Wild Horses Survey
1 Wild Horse
2 Wild Horses
3 Wild Horses
4 Wild Horses
9 Wild Horses
24 Wild Horses
West Douglas Herd Area Boundary
Key Wild Horse Habitat
Preferred Wild Horse Habitat
N
1 0 1 2 Miles
1:162500

Appendix J: References

Axtell, J (2002) Minimum viable populations e-mail message dated November 21, 2002.

BLM Colorado State Office. (1991). BLM Colorado State Office Wilderness Study Report, Statewide Overview, Record of Decision (ROD).

BLM. (1991). Record of Decision: Vegetation Treatment on BLM Lands in Thirteen Western States.

BLM White River Field Office (1999). Environmental Assessment #CO-017-99-93-EA: Twin Buttes Allotment Management Plan.

Coates-Markle, L. (2002). Minimum viable populations e-mail message November 26, 2002.

Coates-Markle, L (2002). Minimum viable populations e-mail message November 25, 2002.

Couvet, D. (2002). Deleterious effects of restricted gene flow in fragmented populations. Conservation Biology. April, 2002. pages 369-376.

Cothran E. Gus. (2002). Genetic Analysis of the West Douglas CO Feral Horse Herd. Department of Veterinary Science, University of Kentucky. Lexington, KY.

Cothran, E.Gus;; Wild horse and burro program research documents e-mail message. May 2, 2003

Krueper, D. J. Bart and T. Rich (2002) Response of Vegetation and Breeding Birds to the Removal of Cattle on the San Pedro River, Arizona (U.S.A.). BLM unpublished manuscript.

Lande and Barrowclough (1987); Effective population size, genetic variation and their use in population management; Cambridge University Press

NTIS (National Technical Information Service), U.S. Department of Commerce. (1980). Wild and Free Roaming Horses and Burros: Current Knowledge and Recommended Research.

Sacceri, I.M. and Koussaari, M. (1998). Inbreeding and extinction in a butterfly metapopulation; Nature Magazine #392; pages 491 – 494

Singer, F. and Zeigenfuss, L. (2000); Genetic effective population size in the Pryor Mountain Wild Horse Herd; Colorado State University

Thornhill, N. W. (1993). The natural history of inbreeding and outbreeding. Chicago University Press

Appendix K: ACRONYMS

AML	Appropriate Management Level
AUM	Animal Unit Month
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CSU	Controlled Surface Use
DEIS	Draft Environmental Impact Statement
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act
GMU	Game Management Unit
HA	Herd Area
HMA	Herd Management Area
IMP	Interim Management Policy
LN	Lease Notice
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
PRMP	Proposed Resource Management Plan
PZP	Porcine Zona Pellucida
RMP	Resource Management Plan
ROD	Record of Decision
TL	Timing Limitation
WSA	Wilderness Study Area

Appendix L: List of Preparers

Name	Title
Caroline Hollowed	Hydrologist
Chris Ham	Recreation Planner
Michael Selle	Archaeologist
Robert Fowler	Forester/Rangeland Management Specialist
Ed Hollowed	Wildlife Biologist
Vern Rholl	Non-Renewable Resources Supervisor
Valerie Dobrich	Natural Resource Specialist/Wild Horse Specialist
Tamara Meagley	Natural Resource Specialist/Rare Plant Specialist
Jim Cagney	Renewable Resources Supervisor
Chuck Romaniello	Economist
Scott Pavey	Planning and Environmental Coordinator